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TUBERCULIN IN DISEASES OF THE EYE.

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NEW YORK.

This paper takes up the indications for the use of tuberculin, the different preparations, the dose, and the proper period for its therapeutic use. It was read before the American Ophthalmological Society, July 9th, 1918, and the interesting discussion it excited is reported page 791.

This paper is written principally for the purpose of exciting a discussion of the questions raised, namely: 1st, In what condition of the eye and its adnexa is the use of tuberculin indicated? 2nd, What form of tuberculin can be used to best advantage in diagnosis and in treatment? 3rd, In what dose and for how long a period should tuberculin be used in the treatment of affections of the eye?

In regard to the first question, it may be held broadly that all of those cases in which a diagnosis of tuberculosis as a cause can be established beyond doubt, and also in the class of cases in which tuberculosis as a cause cannot be satisfactorily established, but in which improvement follows the therapeutic use of tuberculin.

DIAGNOSTIC USE.

In establishing a diagnosis of a tubercular process in the eyes, the subcutaneous injection of old tuberculin "T. O.," is the procedure now generally considered to be the best. Trudeau has found that the subcutaneous injection of 9 mg. of old tuberculin will produce a rise of temperature in a healthy adult; hence it is necessary to employ a smaller dose in conducting this test. In my experience it has been perfectly satisfactory to begin the test with 1 mg. in the adult, ½ mg. in children. (The temperature of the patient should be taken twice in twenty-four hours for one or two days before giving the injection and the injection given only if the temperature is normal).

The injection is repeated if no local reaction (at the site of the inflammatory process in the eye) is obtained forty-eight to seventy-two hours later, provided the patient's temperature has remained below normal for the preceding twenty-four hours, using 2 mg., and again in forty-eight to seventy-two hours, using 3 mg. if a satisfactory reaction is not obtained by the smaller dose. It may be justifiable in certain cases to use a larger dose, as in some cases of small tubercular foci the smaller dose is not sufficient to excite the reaction.

The local reaction in conjunctival tuberculosis is indicated by an increase in hyperemia at the site of the lesion. In scleral and corneal lesions there is increase in pericorneal injection, the conjunctiva nearest the lesion being most affected, slight increase in the density of the tissues at the lesion and in cloudiness of immediately adjacent cornea. In iris tuberculosis an apparent exacerbation of the process is manifest by increase of hyperemia at the base; slight enlargement of the tuberculous masses and haziness of aqueous over the lesion. If the white, fluffy "mutton-fat" exudation is present this may be slightly increased in amount. Some increase in pericorneal injection and slight pain referable to the eye may be produced. The same changes

may also occur in ciliary tubercular processes.

In tuberculosis of the choroid the haziness over the affected area may be increased, the area involved slightly enlarged; and minute grayish punctate patches appear at the margin of the lesion, and vision becomes more impaired. In tuberculosis of the retina and optic nerve head similar changes may be produced. In order to observe these changes the eyes must be examined from time to time from twelve to thirty-six hours after the injection, and the condition compared with that preceding the injection. The reaction in the lighter cases may subside in six or eight hours, and in the severe cases seldom lasts more than forty-eight hours. The condition of the eye, after subsidence of the reaction is usually better than before the tuberculin was given. In no case has the eye been made worse in my experience. In some cases the local reaction is extremely slight, and in some cases of undoubted tuberculosis no local reaction can be detected.

It must be borne in mind that it is not impossible for tuberculosis and syphilis to exist in the individual at the same time; and that the one process may modify the other so that a nodular iritis or a disseminate choroiditis may be influenced by both diseases. The writer has seen two such cases affecting the iris. It is, therefore, desirable in many of the cases to make the diagnostic tests for syphilis as well as for tuberculosis; and in the cases in which both are positive to institute treatment for both at the same time. In fact it is the practice of the writer to give mercury and potassium iodid in moderate dose in very many of the cases in which tuberculosis of the eye exists, as well as to employ general tonic measures in the broad sense of the term. This brings us to the question as to what cases of eye lesions shall tuberculin be used?

LESIONS NOT TUBERCULOUS.

When the writing of this article first occurred to me it was my purpose to inquire whether tuberculins were of any service in the treatment of any disease process other than those excited by the tubercle bacilli. This occurred to me because of the analagous use of diphtheria antitoxin which I found in 1913 was being employed in Glasgow by Dr. Maitland Ramsay in ulcer of the cornea of various kinds, and in some cases of phlyctenular keratitis, with alleged beneficial results; also that it was being used in one of the eye clinics of Vienna in similar affections of the eyes. The rationale for the practice was not very definite, but was based on the supposition that antibodies were introduced in the system which were antagonistic to the agents that were concerned in the production and continuation of the ulcers of the cornea and other eye affections in which it was used.

Although the results obtained by those who used the antitoxin were said to be very good in many of the cases, I have not considered it advisable to adopt the practice. In my reading of literature relating to the use of tuberculin I have not found mention of the use of this remedy for the treatment of any but tuberculous lesions. I raise this question in order to obtain an expression regarding it on the part of the members present. It is quite evident that tuberculin should be employed: (1st) In all cases of diseases of the eye and its adnexa in which a local reaction is excited by the subcutaneous introduction of test doses of tuberculin. (2nd) In those cases of suspected tuberculosis (a) in which a general reaction to tuberculin has been obtained; (b) in those cases of chronic affection of the eye in which a diagnosis is doubtful and in which therapeutic doses of tuberculin prove to be beneficial.

TUBERCULOUS AFFECTIONS.

Tubercular affections of the eye may be roughly classified, as follows:

Lids: Lupus vulgaris, and erythematosus, tuberculous thickening of the tarsus.

Lacrimal apparatus: Lupus of sac and canaliculi, conglomerate tubercle of the lacrimal gland.

Conjunctiva: Lupus vulgaris. Acute miliary tuberculosis following direct infection through a wound. Thickening of tarsus and overlying conjunctiva, more appreciable from the conjunctival surface. In tuberculosis of lids and conjunctiva the preauricular and cervical glands on the side affected are usually appreciably enlarged.

Sclera and Cornea: Tuberculosis of one of these parts of the fibrous tunic of the eye is seldom present without participation of the other, except in cases in which the sclera posterior to the equator is involved. The disease is marked by chronicity; the inflammation is of a low form, the changes characterized by the development of more or less distinct foci, which in the cornea are pale, frequently having a yellow tinge in the sclera, varying according to the degree of thickness and hyperemia of the tissue involved.

It seldom occurs that the entire anterior segment of the sclera is affected, or that the entire cornea is involved, and if this be the case, the degree of the process varies in different parts. An interstitial keratitis closely resembling that observed in syphilis may develop in the cornea, and a sclerosing effect may be produced. Some vascularity, usually superficially located, develops in the cornea. The affection of the anterior segment of the sclera is almost without exception an extension of a tuberculous process from the ciliary portion of the uveal tract.

Phlyctenular Keratitis: Numerous recent studies of this disease appear to show a relation between the subacute or chronic forms of phlyctenular keratitis and conjunctivitis, and tuberculosis. Tubercle bacilli have not been demonstrated in the lesions. But the occurrence of a positive systemic reaction to tuberculin in many of these cases, and the beneficial effect of tuberculin in some, suggests a strong interdependence between tuberculosis and these lesions.

Iris: Tuberculosis of the iris manifests itself in four quite distinct forms. The most common is the development of small yellowish gray nodules, scattered principally throughout the major zone of the iris. These occur in children and young adults as a result of active tuberculosis in some other part of the body. In a high percentage of the cases both eyes are affected.

A second form is the conglomerate tubercle which develops slowly and is accompanied by little inflammatory reaction. It is monocular almost without exception. Third the tubercular granuloma occurring in children.

The three forms mentioned may be accompanied by the white floating "mutton-fat" exudation which is observed, so far as I am aware, only in tubercular affections of the eye.

A fourth form is an affection of the iris which leads to heterochromia and partial atrophy, and is apparently due to ptomain absorption rather than to the actual presence of the bacilli in the iris.

Choroid: This portion of the uveal tract may present the miliary or the conglomerate tubercle and the tuberculous granuloma. Also exudative and disseminate choroiditis of tubercular origin.

Retina and Optic Nerve: The recurring hemorrhages in adolescents are apparently tuberculous in origin in many of the cases, as suggested by Axenfeld and Stock in 1909. Some forms of retinal exudation are tubercular in origin. A papillo-retinitis with the development of conglomerate tubercles is also sometimes observed. This may be accompanied by quite extensive retinal detachment.

KINDS OF TUBERCULIN.

What kind of tuberculin can be used to best advantage in diagnosis and treatment?

Tuberculin "T. O." is a filtrate of tubercle bacilli culture grown on glycerin broth, concentrated by heat to one-tenth of its volume, and then filtered thru porcelain to remove the germs. "T. O." is subjected to a temperature of 60° to 90° C., depending on the laboratory in which it is produced. It "contains the soluble products of the tubercle bacillus in a 50 per cent glycerin solution. It is thought that valuable immunizing properties are lost by the heating process to which it is subjected."

Tuberculin T. R. is made by triturating dried tubercle bacilli into a fine pow-

der, treating the powder with a normal saline solution, and centrifuging. The suspension is thus separated into two layers, the upper layer containing the glycerin-soluble substances, the lower containing the substances left behind after extraction with glycerin. This latter constitutes T. R. Initial dose 1/5000 to 1/1000 mg.

Tuberculin B. E. (bacillus emulsion) is a suspension of one part of thoroughly triturated tubercle bacilli, in 100 parts of distilled water, to which equal parts of glycerin are added. Initial dose 1/5000 to 1/1000 mg.

Tuberculin B. F. (bouillon filtrate) (Denys) is a preparation similar to T. O., except that it is not concentrated by high degrees of temperature. Initial dose 1/10,000 to 1/1000 mg.

Tuberculin T. B. K. (Béraneck) consists of the extracellular toxins of the bouillon culture, together with intracellular toxins extracted from the bodies of the bacilli with 1 per cent phosphoric acid. Theoretically it should contain, as far as possible, all substances having immunizing properties, and avoid the danger common to the emulsions, of containing live bacilli. It is supplied in 15 different solutions, each one double the strength of the preceding one.

Tuberculins T. R. and B. E. are in a sense vaccines, and since they are not subjected to sufficient heat to kill living bacilli, may, (although the trituration is supposed to be sufficiently thoro to destroy all living germs) contain living germs and subject the patient to the danger of infection.

It is generally conceded that tuberculin "T. O." is best suited for use for diagnostic purposes. Other tuberculins can be employed, but the regulation of the dose, etc., has not been so definitely fixed and the results not so uniform. Consequently their employment is not so satisfactory.

For therapeutic purposes T. R. and B. E. are more largely favored, and T. B. K. (Beraneck) is preferred by some.

Although theoretically the tuberculins prepared without heat are superior, since their immunizing qualities are not supposed to be impaired, practically I have obtained fully as good, if not better results from the use of old tuberculin, as supplied by the New York Board of Health, as from any other of the tuberculins; and in some of the cases at least the T. O. tuberculin has been superior. This has proven to be the case so often that I have now come to employ the old tuberculin in almost all cases as long as I see improvement. If improvement ceases I resort to the use of one of the other preparations—sometimes T. R., sometimes B. E. I have found the "B. E." as put up in soluble tablets to be fairly satisfactory, on account of the convenient form and its stability. In all cases when the tuberculin employed fails to improve the condition it is discontinued and another preparation substituted.

DOSE, PERIOD, RESULTS.

In what dose and for how long a period should tuberculin be employed in treating tuberculosis of the eye? It has been my practice to employ tuberculin for therapeutic purposes in a dose just short of sufficient to produce a systemic reaction, and to repeat the dose every four or five days. A systemic reaction may be produced by a very small dose. Stilwill (Annals of Ophth. V. 24, p. 413, 1915), reports a slight systemic reaction from an injection of T. R. 1/400,000 mg. and a strong reaction from an injection of 1/250,000 mg. The writer has employed T. O. in dose of 3 mg. in an undoubted case of tuberculosis, without inducing any appreciable constitutional effect. The range of susceptibility or of sensitiveness to tuberculins is very considerable.

In regard to the length of time over which treatment should be continued, I think that it can be fixed only approximately. Some relapses will occur in spite of most careful management. It is the writer's custom to continue the injections for at least two months, after all signs of activity of the tuberculous focus have subsided; and then to keep the patient under observation and to recommence treatment if any sign of relapse is discovered.

Von Hippel (Graefe's Arch. f.

Ophth. V. L. I. X. p. 1.) reports 243 cases of tuberculosis of the eye treated with tuberculin. Of these there were relapses in 32. The relapses were most frequent in tuberculosis of the uveal tract. Of 75 cases of tuberculosis of the iris and ciliary body, relapses occurred in 15. In the writer's experience relapses in cases of tuberculosis affecting the uveal tract have been most frequent. Relapses in corneal tuberculosis were next in frequency.

TUBERCULOMA OF THE IRIS: REPORT OF CASE WITH MICROSCOPIC EXAMINATION OF THE EYEBALL.

THOMAS A. MULCAHY, M. D., AND JAMES EWING, M. D.,

NEW YORK.

This patient, under observation almost three years, died of intercurrent disease, giving opportunity for complete study of the pathologic conditions present.

Tuberculoma of the iris is not an uncommon condition; but it is rare to have the opportunity to report the pathologic findings, because most of the cases in the recent literature are cleared up under tuberculin treatment.

Tuberculoma of the iris occurs as disseminated tubercles; or as one solitary tubercle which resembles a neoplasm, and was first described by von Graefe as a granuloma, because Virchow, who made the examination, called it granulation tissue.

CASE.—Isabella H., a foundling, aged 3 weeks. She was admitted to the New York Foundling Hospital April 12th, 1915, and was placed in the feeding ward. Weight was 6 pounds 4 ounces. Wassermann blood test made as a routine was negative. She continued to improve in weight and on December 31st, 1915, was sent out boarding. Weight at this time was 13 pounds 8 ounces.

During January, 1916, she had eczema of the head and the body. It was reported that about this time she had a sore left eye, and enlarged fingers; but the exact eye conditions cannot be determined.

September, 1916, it was reported that she had measles, and that the eye condition was about the same. This must have been the German measles.

June, 1917, report states that her general condition was not as well, and that the eye was still sore.

October, 1917, she was admitted to the hospital, and the writer saw her for the first time. Examination as follows: Weight, 22 pounds; looks fairly well nourished; phalanges enlarged, due to increase in size of the bones. Left eye, photophobia and blepharospasm; little circumcorneal injection; pupil contracted; anterior chamber deep and a small yellowish white mass is observed in the lower outer quadrant between the posterior surface of the cornea and the iris. Atropin 1 per cent and yellow oxid of mercury 1 per cent were ordered. Another Wassermann blood test was negative. The atropin did not dilate the pupil because of the synechiae present. October 17th, 1917, a third Wassermann test was negative.

During the second half of October two von Pirquets were made, and were negative. A third was made in the early part of November which was mildly positive.

The child also had a dactylitis and it seemed fair to assume that the eye and finger lesions were similar in origin. The finger lesion had broken down and would discharge pus. It would close up only to break down again. X-ray examination of the hand was made. The report was that the lesion was probably tuberculosis, but other experts said it was syphilis. Then an X-ray examination of the chest was made with the idea of determining the

presence of tubercular lymph nodes. This was negative. There was in addition a lesion in the right vulva; a small tumor, skin over it discolored and at times a cheesy substance could be pressed out of it.

From October, 1917, to early in December, 1917, one grain salicylat of mercury injections were given twice a week, till 12 or 13 injections were given. After this 5 drops saturated solution potassium iodid three times a day for a period of one month. She took the mercury well and increased in weight; the eye condition remaining about the same. While taking the drops she lost her appetite and weight decreased. A fourth Wassermann blood test was made with the idea of its being a provocative one and this was also negative.

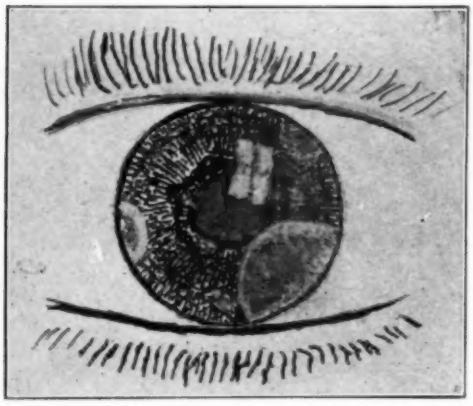


Fig. 1. Tuberculoma of the iris (Mulcahy's case).

January 11th, 1918, Dr. Martin Cohen and Dr. M. Uribe-Troncoso saw the patient with me and a very careful examination of the eye was made. The following notes were made at this time:

1. Infiltration of the cornea.
   a. Over mass or tumor but smaller.
   b. Over 2 o'clock and 9 o'clock were two small spots which looked as if there were daughter tubercles in the iris underneath them.
2. Aqueous clear.
3. Pupillary space covered over by a fibrous exudate.
4. Yellowish white mass, spherical in shape, size of a pea, surface regular, border sharply outlined, mass comes in contact with posterior surface of the cornea; few blood vessels on surface of the mass.
5. Fundi negative.

Right eye normal.

The general tuberculin reaction was suggested and now made. Two hour temperatures for two days were found to be normal, before the date of injection of one-quarter milligram of old tuberculin on January 23d, 1918, at 1 P. M.; and exactly at 1 P. M. January 24th, or 24 hours later, the maximum rise to 101 degrees was reached. During this time the child suffered from general malaise, and did not want to take food. Circumcorneal injection increased and there was more redness about the finger lesion. The temperature gradually returned to normal and the circumcorneal injection and the redness about the finger became less. A raised red area about the size of a dime appeared at the site of the injection 12 hours after, and increased to the size of a nickel. In the center of this area appeared a white spot.

On February 5th, 1918, the temperature having remained normal, tuberculin injections of the B. E. were begun. First dose of .00001 Feb. 5th; .00002 Feb. 7th; .00003 Feb. 11th. On Feb. 12th the temperature arose to 102 degrees so the injections were stopped because it was thought that the rise of temperature was due to the tuberculin injection.

The rise of temperature was caused by an attack of measles. There were a number of cases in the hospital at the time, but as it had been reported that the child already had measles it was not expected to have another attack. But it is probable that the first attack was the German measles. The attack was complicated with lobar pneumonia from which the child died on March 4th, 1918.

PATHOLOGIC FINDINGS.

Autopsy was made by Dr. C. A. McCarthy of the Visiting Staff of the hospital and the lesions found were double lobar pneumonia, many caseous bronchial lymph nodes and amyloid liver.

The left eye, one finger and lymph nodes were removed for pathologic study which was made by Dr. James Ewing of Cornell University Medical College. Report as follows: The main pathologic features in the material presented in this case are:

1. Advanced caseation of the bronchial lymph nodes.
2. A recent granulomatous and necrotic inflammation of the bone marrow and periosteum of one finger.
3. A recent and active granulomatous process in the iris.

1. The caseous process in the bronchial lymph node is a typical advanced tuberculous inflammation.
2. In the periosteum there is a subacute productive inflammation with many lymphocytes splitting up the layers of the periosteum and gathered in foci about the blood vessels. In the bone marrow there is a focus as large as a pea, which consists of lymphocytes, proliferating fat cells and some large cells, with central necrosis; but without giant cells. These changes are strongly indicative of tuberculosis.
3. In the iris and about the ciliary body there is a rich infiltration by lymphocytes, plasma cells, and proliferating blood vessels; and in the blood vessels and about them are many polynuclear leucocytes. At several points there are focal collections of lymphocytes. These changes are consistent with a tuberculous origin.

In view of the tuberculous character of the lymph node lesion, and the probable tuberculous nature of the osteomyelitis, there is strong ground for concluding that all the lesions are tuberculous.

The tubercle bacilli were looked for in the eye lesion but could not be demonstrated, by a competent bacteriologist.

COMMENT.—The value of the general tuberculin reaction was clearly demonstrated in this case. Before its use the diagnosis was for the most part a mere guess of probably tuberculosis. After its use the diagnosis was without question tuberculosis. The reporter hesitated to make the general tuberculin reaction because of the age of the patient, less than three years at the time of use, but positively no harm was done.

The first and second von Pirquet's tests were negative and the third was slightly positive. In children this test is expected to be of the greatest value, but in this case one could say that it was an uncertainty. Perhaps this was so because the case was one of bone tuberculosis; and it may be as in bone syphilis, the Wassermann blood test is more apt to be negative than positive.

The fact that vigorous antisyphilitic treatment did not benefit the patient, and that the four Wassermann blood tests were negative ought to exclude any suspicion of syphilis.

VALUE OF THE X-RAY EXAMINATIONS. That of the hand showed characteristic single lesions on the plate, which if taken alone could be either syphilitic or tuberculous, in other words some of the bone lesions showed proliferation and others destruction. But the destructive lesions were more marked, hence the X-ray of the hand was clinically tuberculosis.

It is a well known fact that tuberculosis of the iris and ciliary body is always secondary to tuberculous bronchial lymph nodes. X-ray examination taken to determine the presence of bronchial lymph nodes was negative; and yet an autopsy, which was made about four months after the X-ray examination, showed many bronchial lymph nodes.

While the conglomerate tubercle was the most conspicuous lesion in the case, there were in addition two very small pin head spots in the iris which were daughter foci; and a general plastic iritis as evidenced by the posterior synechiae.

TOWER SKULL WITH DOUBLE OPTIC NERVE ATROPHY

MICHAEL GOLDENBURG, M. D.

CHICAGO, ILL.

Acting Surgeon Illinois Charitable Eye and Ear Infirmary.

Report of a case illustrated with photographs of the patient, and X-ray pictures of cranium and contents.

Anomalies in the development of the skull are very common and have been thoroughly studied by workers in this particular branch of pathology.

The tower skull oxycephaly, or "thurmschädel," as the Germans call it, is of special interest to us as ophthalmologists, owing to the frequent pathologic eye findings associated with this condition. Not that the ocular changes are found only in this particularly shaped head, or that ocular lesions are always found here, but this class of patients come to us as ophthalmologists for the eye affection; and we find this probably the most common deformity of the head. Again, it is quite probable that malformations of the head are more commonly the cause of eye lesions, than one is led to believe from the available literature. We find, for example, that up to 1912 only 26 cases of tower head had been reported. Enslin (1), who was looking for these cases over a period of two years, out of 9,380 eye patients found 16 cases of this kind. It is quite apparent that if we do not look for a special condition we do not find it, unless it is an extremely marked case, as in the one we present.

Tower skull, per se as the cause of eye disease, is still problematic, for we find a number of cases reported of this shaped head, without any eye lesions at the time of examination; of course it is quite possible that a transitory eye lesion might have been present, and had left no demonstrable evidence later in life when examination was made.

One could reason that this definite skull malformation must have some influence, for we find that in all the cases reported we have virtually one eye lesion and that an affection of the optic nerve. In the 42 cases reported, 36 had a post neuritic atrophy, 2 with a double neuro-retinitis, 2 with one sided papillitis and post neuritic atrophy, and 2 cases with primary optic atrophy.

The question arises whether the tower skull is the direct or indirect cause of the optic nerve lesion. The theory propounded, that the casual factor responsible for the malformation of the skull is also the cause of the optic nerve lesion, has a number of adherents.

We find that maldevelopments of the skull are due to a premature ossification of the different sutures, and in this particular form the coronal suture is closed very early with compensatory development in height, which corresponds with Virchow's dictum, that the development or maldevelopment takes place vertically to the closed suture.

The probable cause of the premature ossification of this suture, the time of onset, whether intra- or extrauterine, is very interesting and much can be said, but we shall only state, at this time, those essentials that might be associated with the eye lesions.

In a number of the cases reported, and in the one we are presenting, we are inclined to believe that this process began during the prenatal period.

That an osteitis is present, and is the probable cause of the premature ossification of the sutures, nearly every one is agreed upon. The etiology of osteitis, at least in adult life, is infection of some character. That a metastatic infection during intrauterine life is possible there is no doubt and is not strange to ophthalmology.

The theory of excessive nutrition of the bones possibly brought about by a passive hyperemia, as propounded by

Bier and referred to by obstetricians under the caption of abnormal positions or flections of the fetus, must also be given some consideration.

Michel (2) states that he is inclined to think that the change in the growth of bone is due to an increased process of nutrition.

We have, then, an osteitis, whatever the cause of this may be, and an osteitis is invariably associated with a periostitis, the dura here acting as a periosteum; it is reasonable to assume that this process extends to the optic foramen, thus decreasing the caliber of this opening, and in this way producing a papillitis. This has been found to be true in two cases reported that came to the post-mortem table. Ponfick (3) in 1886 reports such a case. Manz (4) also reports a similar case in 1885.

Enslin working upon this theory visited the anatomic museums at Heidelberg and Breslau and found six such skulls, but could discover no constriction of the optic foramina; he, however, states that this does not entirely detract from this theory, as the skulls he examined were very old and very dry.

Hirschberg (5) is inclined to think that the cranial deformity and the eye disease are often to be referred to the same cause, namely an inflammation of the dura and the bone.

Virchow (6), who examined a number of Hirschberg's cases, concurs in this view.

The factor of hydrocepalus, internal or external, as the cause of the eye lesion per se, is of considerable importance. Whether this is a transitory form as suggested by Friedenwald (7) or the result of premature ossification of the sutures remains an open question. The literature on this phase is not as extensive as on the previously mentioned theories. The case presented here is of more than passing interest, in that we to our knowledge apparently have the advantage not possessed by earlier observers in our Roentgenographs.

The history in our case plus the X-Ray plates will, we believe, throw some light on this obscure subject.

CASE.—The family history as far as we could ascertain is apparently negative, on both sides of the family tree. The mother of our patient has two additional children living, and as far as one can see they are perfectly normal. The photograph shows an older sister. One child died of a valvular lesion.

The mother states that all her labours were normal, but that she had some difficulty with our subject. The attending physician had found the head rather long, but succeeded in delivering her without the use of instruments.

Fig. 1. Tower skull. (Goldenburg's case), with older sister.

When the child was born it had many soft spots on the top of the head, particularly in the center, where the mother says there was noted a marked thumping. The front part of the head was hard. Both the veins and arteries over the temples were very prominent and a marked pulsation was present, particularly so upon the left side. There seemed to be a large hard protrusion somewhat above and back of the left ear.

Physicians who saw the case at that time thought the child had been delivered by instruments. The child had great difficulty in nursing and breathing at the same time; and even when

not nursing, breathing sounded as if she were choking. The attending physician was inclined to think that there was a growth in the nose, but nothing

Fig. 2. Goldenburg's patient showing prominent eyeballs and divergent squint.

was attempted in this direction. The attending physician's opinion in regard to her head at this time was that she had water on the brain.

As regards the eyes, they were very prominent and the child did not seem to show evidence of being able to see very much, as far as the mother can remember. The child had no lesions of any kind on the skin and was apparently otherwise normal. When four months of age she developed a rash on the left cheek and later also on the right cheek, but this rash soon disappeared.

At the present time we have the tower skull with a bitemporal circumference of 17¾ inches. A sagittal measurement of 14¾ from nasion to occipital protuberance. Perpendicular from nasion to highest point of the skull of 5½ inches and an anterior posterior diameter of 5½ inches.

The eyes are very prominent, but it is questionable whether this condition can be called a true exophthalmos. The eyeballs are very large and the sclera thin. The cornea normal in size, transparency, and sheen. We have a divergent strabismus with a marked horizontal nystagmus.

Anterior chamber and iris are negative. The pupillary opening is about 6 mm. and equal in both eyes and reacts very sluggishly to bright light. Tension negative. Vision in R eye—Nil. Retinoscopy R — 5.00 in both meridians with no improvement in vision.

L. 4/200—6.5 ⊃ —3.5 cy. ax. 150 = 8/200.

Fundi.—Disks a dirty gray and outlines not well defined; there is an uncertainty as to the caliber of the vessels, owing to the marked nystagmus, but we are inclined to think that there is some evidence of a perivasculitis. Direct opthalmoscopy was very difficult and unsatisfactory.

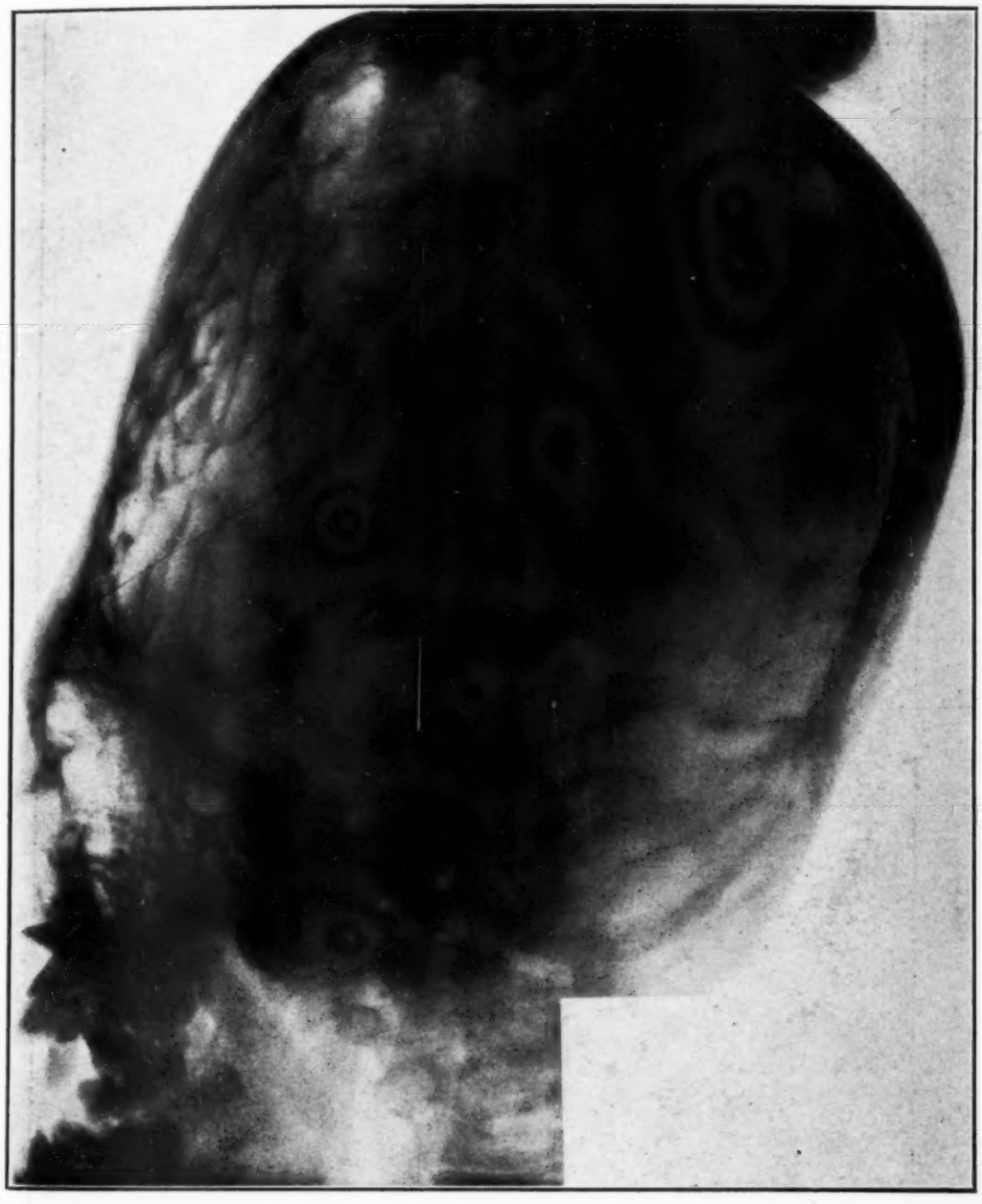
Nose.—Vestibule of nose negative. Septum appears as if it had been pressed down upon and lies spread over the floor of the inferior meatus, while there is a pronounced deviation high up.

There is a wrinkling of the skin around the mouth, with no evidence of scars, a similar wrinkling of skin, but very much more marked and almost

Fig. 3. Side view showing peculiar shape of skull.

black, as if dirt had been ground into it, is noted over the abdomen, axillae and on legs, which was pronounced by a

ANTERO-POSTERIOR ROENTGENOGRAPH OF GOLDENBURG'S CASE OF TOWER SKULL, SHOWING FORM OF SKULL AND IRREGULARITIES OF TEETH



ROENTGENOGRAPH OF GOLDENBURG'S CASE OF TOWER SKULL, LATEREL EXPOSURE, SHOWING FORM OF SKULL, IRREGULAR THINNINGS AND GROOVE OF MENINGEAL ARTERY

dermatologist as an ichthyosis with an abnormal distribution.

The teeth are in bad condition and the alveolar process of the superior maxilla is very thick; the hard palate is very high and the greatest distance between the base of arch is 5/16 of an inch. The soft palate is very long, but otherwise negative. Inferior maxilla negative.

EARS.—Externally negative; drums—absence of sheen and slightly retracted. Hearing very acute both for low and high tones, a rather remarkable feature is that the bone conduction is as great and some times greater than the air conduction.

General health good; her only complaint is that of a little pain over eyebrows, especially in cold weather.

Mentally, when one takes into consideration the vision and lack of education, we can say she is quite bright. Plays the piano.

Our roentgenographs show the skull to be very irregular in thickness with numerous depressions on the inner table undoubtedly formed by the convolutions of the brain. Suture lines were not demonstrable; and the grooves of the meningeal vessels or diploic veins were markedly accentuated. The sella turcica was approximately normal in size. No evidence of pathology responsible for the exophthalmos. The roentgenographer further states there is premature ossification of the sutures leading to a condition known as internal hydrocephalus, and the increased intracranial pressure is responsible for the peculiar markings on the inner table.

Owing to the peculiar facies we were inclined to think of congenital lues, but this had to be excluded by the family history, clinical and scrologic findings. Urinalysis negative. Tuberculin tests were not made.

It seems to us that this case is well worthy of presentation for several reasons. The apparent evidence of the disease during the prenatal period. The fact that 75% of these cases are seen in the male, and by far the largest percentage of total or partial blindness occurs in the male. Most of the cases are not recognized until long after birth, when the patient usually comes in for some other condition, or his or her failure to pass some eye examination. When a post neuritic atrophy or a primary atrophy is found, and the thought suggests itself to us, that possibly some of the so called amaurotic eyes could be explained upon these grounds.

According to von Graefe, the atrophy following a neuritis can for a long time be recognized as such, but not forever, as later it cannot be differentiated from a primary atrophy.

The fields are as a rule the same as in papillitis, i. e., concentric contraction. Where vision was good there was found no enlargement of the blind spot.

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THE INERTIA OF ADJUSTMENT OF THE EYE FOR CLEAR SEEING AT DIFFERENT DISTANCES.

A Study of Ocular Functions with Special Reference to Aviation

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This is a study of the time required to adjust the eye for clear seeing at different distances. The article contains a description of the apparatus and method used in making the determinations and a statement of the results obtained under certain selected conditions. Other types of ocular lag are also considered briefly in passing and points bearing on the application of the method to the selection of aviators, to the work of the clinic, etc., are discussed.

Read at the Fifty-fourth Annual Meeting of the American Ophthalmological Society, July 10, 1918.

By inertia of adjustment is meant here the lag in the action of the extrinsic and intrinsic muscles in adjusting for clear seeing at different distances. The amount of lag in this function is found to vary a great deal from individual to individual. In the results to be presented, the minimum time required to change from the adjustment for clear seeing at or near the near-point to that for clear seeing at 6 meters, and the converse, has been measured in several cases.

So far the investigation has been conducted primarily as a study of the method, with special reference to its applicability as a test of fitness for vocations for which speed and accuracy of adjustment are a prerequisite. In this particular especially, the writers believe that the aviator must excel. The rapid development of the science and art of aviation, brought about by the present war, emphasizes the need for tests which will facilitate the selection of the supernormal eye. It is scarcely to be expected that the conventional clinic tests, designed more particularly for the separation of the subnormal from the normal eye, are fully adequate for this purpose.

It will be obvious, without discussion perhaps, that in estimating the fitness of an instrument, apparatus, or human organ for a particular task, or for the range of work which it may be called upon to perform, other aspects besides maximum power or capacity of response should be taken into account. Some of these are lag, steadiness or stability of response, power to sustain response, rate of fatigue or decay of response, rate of recovery, etc. All these functional aspects are present in particular in case of the eye, and their variation from time to time in a given eye and from eye to eye can be measured with a degree of precision that is adequate at least for many comparative purposes.

As has already been indicated, we have been concerned in the present work with only one of these aspects, namely, the *lag* in the eye's reactions to its stimulus. In the study of this phenomenon at different times in our laboratory, three subdivisions have been made: the lag in the response of the retina to colored and colorless light, and its change with change in the intensity of light; the lag in the adjustment of the eye for clear seeing at different distances, and the lag in the development of the perception of depth or distance. The relation of all these to the functional efficiency of the eye will be considered very briefly in passing.

LAG IN RESPONSE OF RETINA.

Because of its small order of magnitude, the first of these types of lag is of comparatively little importance in most of the uses to which the eye is put. In all acts of seeing, for example, in which a change of adjustment is required, the lag in the retina's action is insignificant in amount, as compared with the lag in the muscular action. It becomes of importance only in such uses of the eye as permit of a very short exposure to its stimulus, usually with the muscular adjustment already made, or in cases in which it is important to have the maximum response of which the eye is capable.

Examples of the former may be found in various uses of the eye in the technical work of the laboratory; and of the latter in signaling with colored and colorless lights. In order to show something of

the order of magnitude of the lag in the retina's response and its variation with the wave-length and intensity of light used, we have constructed curves in which the sensation as it rises to its maximum value is plotted in just noticeably different steps against time of exposure. These results were obtained in our laboratory three years ago, in a comparative study of methods of determining lag.

We are indebted for them to M. A. Bills, a former graduate student.

Four of the most promising of the older methods and three new ones were used in making the determinations, and the results of these methods were checked against each other. The comparative study was made thruout on the same observers.

The dominant motive in making this study was to find or devise a method which would have sureness of principle and precision, and at the same time the feasibility that is needed for practical applications. One of the new methods was found to answer surprisingly well to these requirements, considering the nature and difficulty of the problem. The lights employed were narrow bands in the red, 686$\mu\mu$; yellow, 588$\mu\mu$; green, 511$\mu\mu$; and blue, 463$\mu\mu$; and white light. The colored lights were taken from the prismatic spectrum of a Nernst filament, and the white was synthesized from this spectrum. The lights were all made photometrically equal; and, in addition, for the sake of more absolute specification, their physical intensities were measured by means of a thermopile.

The results obtained showed that observers differ in all the following regards: Amount of lag for a given stimulus, the amount of difference in the lag for the different wave-lengths and for white light, and the effect on these differences of changing the intensity of light. Three intensities of light were used, 0.057, 0.151, and 1.21 meter-candles. For the lowest of these intensities the rate of rise to the maximum was in the following order: Yellow, red, blue, green, and white, the time of the maximum ranging between 0.1 and 0.22 sec.

For the highest intensity the rates of rise were in this order: Green, yellow, white, and red,—the time required to reach the maximum ranging between 0.085 and 0.14 sec. Blue was omitted from this series because it could not be obtained at the required photometric value with the apparatus used. At the intermediate intensity, a transition condition is shown. In passing over a certain range, low in the intensity scale, to points higher in the scale, there is a radical change in the order of rate of rise, tending toward a complete reversal at high intensities; while at intermediate points in the scale the lag is shown to be in a state of transition between what is present at low and at high intensities. An increase in intensity is found also to lessen the lag very considerably or to increase the rate of rise.

These details, however, are much more important in certain phases of the use of the eye in laboratory technic, for example, than they are in immediate relation to the work of the present paper. Our purpose in introducing them here is, as we have already indicated, merely to give some general idea of this feature in the eye's slowness in responding to its task, and in particular to show that, as compared with the inertia of adjusting clearly to receive its impression, the inertia in its sensory reaction is relatively unimportant for most of the work which it is called upon to do.

LAG IN DEPTH PERCEPTION IN STEREOSCOPIC VISION.

So far our investigation of the lag in the perception of depth has been made in stereoscopic vision, and for an entirely different purpose than the grading of individual capacities. The results show, however, that depth comes into the percept later than height and breadth and color and brightness, and that the amount of lag varies for different observers. Whether this type of lag could be made a feasible basis for the grading of individuals for vocational purposes we are not prepared at this time to say. Speed and accuracy in judging distance are doubtless important items in the qualification of an aviator, for example; and it may be possible to work out feasible tests for certain fundamental aspects of the ocular foundation of this ability.

Indeed the lag in the adjustment of the eye for clear seeing at different dis-

tances should sustain a somewhat fundamental relation to speed of judging distance, since both the adjustment of the eye and the clear seeing of objects are in general the important ocular functions involved in the judgment of distance. Unfortunately for our purpose, however, the judgment itself is not an ocular function. The eye provides only the criteria, —and a very complex set of criteria at that—from which the individual learns by experience to form his judgment of distance.

The testing of these extraocular capacities, the ability to estimate distance, more especially under an entirely new set of conditions for which definite standards or patterns are wanting, is perhaps just as important as the testing of the ocular capacity itself. The testing of the ocular capacity, as registered in certain simple space judgments, with or without the element of time, or speed of performance, is capable of definite treatment. All that can be said of the remainder of the problem is that it is open to investigation.

LAG IN ADJUSTMENTS FOR DISTANCE.

On quite a different methodologic plane, however, is the determination of the lag in the adjustment of the eye for clear seeing at different distances. The making of these determinations by the method we have used involves no extraocular capacities of a higher order than are required in the acuity tests for illiterates. Moreover, a direct objective check is applied to the subjective judgment. That is, the letter E, built to scale and turned in different directions, is used as a test-object for the different distances, and the observer is required only to indicate the direction in which the letter points in any given case. Such testing of human functions, even without the objective check, is, so far as method and principles of testing are concerned, just as definite as the testing of those physical instruments, the responses of which must be read by the eye from a moving pointer and scale or their equivalent.

Our purpose in making these tests has been, as we have already indicated, primarily to ascertain whether eyes, rated by the clinic tests as normal or approximately so, can not be more finely graded as to their working efficiency or fitness for special purposes, when other important functions than those considered in the clinic tests are taken into account. For this purpose we have aimed, therefore, to test for the greater part only eyes that have been passed in the clinic as normal, or as having defects so insignificant as not to need correction. Ninety-four percent of the eyes of this group were able to read quite readily at 6 meters under 5.2 foot-candles of light, the test type designed to be read at 4 meters; and the remaining 6 percent, the type designed to be read at 5 meters. In addition a few were tested whose eyes were corrected by glasses.

This was done for the purpose of getting results comparative of the performance of eyes corrected to standard according to the norms of the clinic, and the uncorrected normal eye. All but one of the uncorrected group were between 18 and 28 years of age, and only one of the corrected group was over 28. Three of the observers had worked pretty steadily for a year or more with high-power microscopes, four were trained in the observations of physiologic optics, and the remainder were selected at random from the college community. The best results were obtained from one of the three who had been trained in the use of a high-power microscope, but her results were closely rivaled by those of a college sophomore whose eyes and observational powers had received no special training. However, the results of the three whose eyes had received special training in the use of the high-power microscope averaged rather strikingly high. To what extent speed of adjustment can be trained is yet to be determined.

Fortunately for the feasibility of the test, the immediate practice effect is low; or, more properly speaking, it is rather high in the initial observations, but soon ceases to be troublesome. Also the precision for any given set of determinations is high. As might be expected, tho, there is a diurnal variation in the results corresponding to the diurnal changes in the function tested. The maximum range

of these variations, however, is small, as compared with the range of variation between individuals. It is not great enough, so far as we have thus far been able to determine, seriously to affect the grading of eyes with sufficient precision for practical purposes on the basis of the tests taken at any one time chosen at random. The fact that there is a diurnal variation suggests, however, that if the test be used as a check on fitness for aviation, it might be of advantage to determine each individual's norm and require a short test before each flight, or as often as may be needed to keep track of the variations and to safeguard against the more serious depressions that may occur.[1]

The working distance for the far object was chosen at 6 meters and for the near object as 18 cm. The far object at this distance subtended a visual angle of 7 min.; the near object, 14.8 min. In choosing both the working distance and the visual angle for the near objects, care was taken not to approach too closely to the limiting values. This was needed to safeguard the results against individual differences in the nearpoint and in acuity. That is, it was found that unless these limiting values were too closely approximated, small variations either in the visual angle or in the working distance produced little difference in the results.

Since our problem was in part to devise and try out apparatus, the determinations have been made with two types of apparatus, one of which is slightly simpler in construction and use than the other. By means of the more complicated apparatus, however, a more complete analysis of the problem is possible. That is, by means of the simpler apparatus it is possible to make the following determinations: the lag of perception with the eye in approximate adjustment for the near object, the time required to change from this adjustment to that required for far seeing, and the time required for the double excursion, *i. e.*, from near to far and back again to near; while by means of the other apparatus we were in addition able to break up the double excursion into its two halves, the time required to pass from near to far and back again to near. By means of the second apparatus, moreover, all the determinations may be made in a single swing of the compound pendulum governing the time of exposure.

There is another advantage of the second apparatus which came out quite plainly whenever a comparison of results was possible on the same observer. That is, in its use a provision was made to cut off the test-object just as soon as it was discriminated. The eye was not allowed to linger on the far object, as was its tendency when the double excursion was not broken up into its two halves. The value of the double excursion, as determined directly by the first apparatus was, for example, appreciably longer than when it was determined by adding together the values of the two halves as determined by the second apparatus. This tendency of the eye to linger where it can, thus not only makes a difference

[1. If a check is wanted on the diurnal variations in other motor coördinations, as well as those of the eye, a reaction experiment involving choice may readily be combined with the ocular experiment. Two forms of this reaction experiment are suggested: (1) A four-finger reaction key may be used, each of the keys to indicate one of the four possible positions of the letters—up, down, right, and left. That is, the observer, just as soon as each letter—near, far, and near—is discriminated, indicates the direction in which it points by pressing the proper key. (2) A wider range of coördinative ability could be tested by having two keys operated respectively by the right and left hand, and contacts by the right and left foot. By soldering contacts on each edge of the exposure discs in circuit with an electromagnetic marker, and by having the reaction keys and foot contacts also in circuit with electromagnetic markers, the length of exposure for each test-object and the reaction times could all be recorded simultaneously on a kymograph, together with a time line traced by an electric tuning fork. With these records as a check on the quickness of the motor functions of eye, arms, and legs, and the mental functions involved in choosing, it would seem scarcely possible that the aviator could grow stale or suffer even temporary depressions of any consequence without the knowledge of the laboratory corps. Also, from the accumulated records a comparative rating of the stability of the men could be made. It may be, of course, that the eye records alone will serve as a reliable index of the variations in the observer's general condition, but that correlation has not as yet been investigated.]

in the absolute value of the results, but there is a danger that it may affect also the comparative values. That is, the latitude offered not only gives a chance for a variable performance or a variable error from time to time with the same observer, but it leaves the results open to the influence of this factor in case of different observers.

Obviously the test may be used in two ways: (1) Records may be made of the maximum performance of each individual. This would be the analog of making acuity tests in terms of the minimum visual angle each observer is able to discriminate. This procedure is the longer of the two, but results in a much finer grading of performance. (2) Two, three, four, or

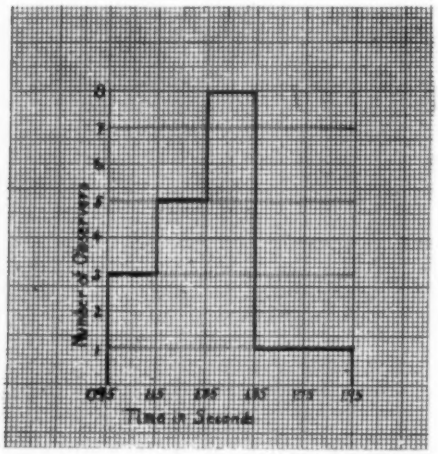

Fig. 1. Representing the relative distribution of eighteen observers graded with reference to speed of adjustment for clear seeing at different distances.

any suitable number of levels of performance may be chosen, and the apparatus set at once to give these levels. This method of testing would roughly place individuals into ranks or groups and is the analog of the Snellen method of grading acuity. It is a much quicker procedure but the grading made is correspondingly rough.

By this method the ranking or testing of a given individual by a practiced person should occupy but a few minutes. The results given in this paper were obtained entirely by the former method. It is obvious that the latter method could not be used until sufficient work had been done by the former to establish the required norms for the vocation or purpose in question. Results obtained with the two types of apparatus are shown in Table I and II. For the greater part of the results given in Table I we are indebted to M. Almack, a graduate student in our laboratory.

A graphic representation of these results is given in Figure I.

Since these tables are somewhat detailed, it may be of advantage to give in advance a few points by way of a very general statment of results. The time required for the 18 normal observers to pass from near to far varied between 0.50 and 1.16 sec., a range of 132 percent; from far to near, between 0.39 and 0.82 sec., a range of 110.3 percent; and from near to far and back to near, between 0.96 and 1.76 sec., a range of 83.3 percent. Of these observers, 83 1-3 percent required longer to change from near to far than from far to near. The longer time to pass from near to far may to some extent, of course, have been due to the smaller visual angle subtended by the far object. That is, the time required to discriminate the far object may have been increased by its relatively smaller angular value.

If a rough classification by rank were wanted, they might readily be divided into three or more groups, with abundance of difference between groups for a graded setting of the apparatus. If, for example, three groups are chosen,—fast, medium and slow,—fast ranging between 0.96 and 1.25 sec., medium between 1.25 and 1.55 sec., and slow between 1.55 and 1.85 sec.,—28 per cent would fall in the first class, 55 percent in the second class, and 17 percent in the third class. The observers who wore glasses all group together with the slowest of the normal class. The time from near to far for these observers ranged between 0.89 and 1.17 sec.; from far to near, between 0.41 and 0.68 sec.; and the time for the double excursion, between 1.48 and 1.58 sec. The fastest of this group was 54.2 percent slower for the round trip than the quickest of the normal group.

TABLE I.

Showing the inertia of adjustment of the eye for clear seeing at different distances.

Observers with normal eyes—Apparatus I.

Observer	Age	Degree Values			Time Values (Sec.)			Individual differences Deviation from quickest				Supplementary data			
		Near object	Near to far	Near to far and back to near	Near object	Near to far	Near to far and back to near	Near to far		Near to far and back to near		Acuity	Near point (cm.)	Refraction	Muscles
								Sec.	Percent	Sec.	Percent				
Sl	25	1	31	64	0.02	0.50	0.96	...	...	...	...	O. D. : 6/4	11.5	Emmetropic	
												O. S. : 6/4	12.5	+ .12 cyl. ax 90°	1 Exo
Fl	26	1	42	73	0.02	0.68	1.05	0.18	36.0	0.09	9.4	O. D. : 6/4	12.5	+ .50 S. + .25 cyl. ax 0°	
												O. S. : 6/4	12.5	+ .62 S.	2⅔ Eso, ⅓ LH
St	23	1	38	85	0.02	0.64	1.17	0.14	28.0	0.21	21.9	O. D. : 6/4	10.4	+ .25 S. + .25 cyl. ax 75°	
												O. S. : 6/4	10.4	+ .25 S. + .12 cyl. ax 90°	2½ Eso, 1 RH
C	25	1	44	103	0.02	0.72	1.37	0.22	44.0	0.41	42.7	O. D. : 6/4	11.3	— .25 cyl. ax 80°	
												O. S. : 6/4	11.3	— .12 cyl. ax 95°	2 Exo, 1 RH
Mc	27	1	53	105	0.02	0.77	1.41	0.27	54.0	0.45	46.9	O. D. : 6/4	12.5	Emmetropic	
												O. S. : 6/4	12.5	Emmetropic	1 Eso
Ln	26	1	39	105	0.02	0.65	1.41	0.15	30.0	0.45	46.9	O. D. : 6/4	11.5	+ .25 S.	
												O. S. : 6/5	10.5	— .25 S.	1¼ Eso, 1 RH
F	40	2	54	124	0.04	0.775	1.85*	0.275	55.0	0.89	92.7	O. D. : 6/4	15.0	+ .12 cyl. ax 120°	
												O. S. : 6/4	15.0	+ .12 cyl. ax 15°	3 Eso

*Compare this result with that obtained with the same observer with Apparatus II. It will be remembered that we have stated (p. 767) that a longer time was required for the double excursion with the first apparatus than with the second in all cases in which the determinations were made on the same observer, owing to the tendency of the eye to linger on the far object when no provision was made to cut it off just as soon as it was discriminated.

TABLE II. OBSERVERS WITH NORMAL EYES, APPARATUS II.

Observer	Age	Degree Values: Near object	Near to far	Far to near	Near and back to near	Time Values (Sec.): Near object	Near to far	Far to near	Near and back to near	Individual differences: Deviation from quickest. Near to far Sec.	Near to far Percent	Far to near Sec.	Far to near Percent	Near and back to near Sec.	Near and back to near Percent	Acuity	Near point (cm.)	Refraction	Muscles
H	19	1	48	44	92	0.02	0.63	0.39	1.02	...	...	...	...	...	...	O. D. : 6/4	10.3	Emmetropic	1½ Eso.
																O. S. : 6/4	10.3	Emmetropic	Add : Abd = 20 :9
Lz	25	1	58	48	104	0.02	0.75	0.42	1.17	0.12	19.0	0.03	7.7	0.15	14.7	O. D. : 6/4	12.5	— .12 cyl. ax 0°	3 Eso, 1 RH
																O. S. : 6/4	13.0	Emmetropic	Add : Abd = 26 :5
Bk	25	1	59	55	114	0.02	0.77	0.47	1.24	0.14	22.2	0.08	20.5	0.22	21.6	O. D. : 6/4	13.0	+ .12 cyl. ax 60°	½ RH
																O. S. : 6/4	12.5	+ .12 cyl. ax 120°	Add : Abd = 22 :11
L	19	2	59	64	123	0.04	0.76	0.565	1.325	0.13	20.6	0.175	44.9	0.305	29.9	O. D. : 6/4	11.0	Emmetropic	1 Exo
																O. S. : 6/4	8.6	— .25 cyl. ax 5°	Add : Abd = 10 :8
Rg	28	1	55	70	125	0.02	0.715	0.61	1.33	0.085	13.5	0.22	56.4	0.31	30.4	O. D. : 6/4—	12.0	— .12 cyl. ax 122½°	1¼ Eso
																O. S. : 6/4—	13.0	Emmetropic	
Ty	24	1	55	87	145	0.02	0.69	0.76	1.45	0.06	9.5	0.37	94.9	0.43	42.2	O. D. : 6/4	12.0	Emmetropic	1 Exo
																O. S. : 6/4	10.5	Emmetropic	Add : Abd = 22 :7
D	22	1	51	63	114*	0.02	0.825	0.675	1.50	0.195	31.0	0.285	73.1	0.48	47.1	O. D. : 6/4	9.5	— .12 cyl. ax 157½°	¾ Eso
																O. S. : 6/4	9.5	— .25 cyl. ax 17°	Add : Abd = 18 :5
S	24	2	68	75	143	0.045	0.85	0.66	1.51	0.22	34.9	0.27	69.2	0.49	48.0	O. D. : 6/5+	10.5	— . 25 S.	1 Eso
																O. S. : 6/4	11.0	Emmetropic	Add : Abd = 14 :8
F	40	1	64	81	145	0.02	0.79	0.73	1.52	0.16	25.4	0.34	87.2	0.50	49.0	O. D. : 6/4	15.0	+ .12 cyl. ax 120°	3 Eso
																O. S. : 6/4	15.0	+ .12 cyl. ax 15°	Add : Abd = 12 :3¾
B	19	1	56	92	149	0.02	0.705	0.82	1.525	0.075	11.9	0.43	110.3	0.505	49.5	O. D. : 6/4	9.0	— .25 cyl. ax 150°	1 Eso, 1⅛ RH
																O. S. : 6/4	11.0	— .25 cyl. ax 5°	Add : Abd = 20 :10
M	18	1	79	70	149	0.02	0.94	0.635	1.575	0.31	49.2	0.245	62.8	0.555	54.4	O. D. : 6/4	8.0	Emmetropic	1 Exo
																O. S. : 6/4	8.0	Emmetropic	
Rs	24	2	98	60	158*[1]	0.06	1.16	0.60	1.76	0.53	84.1	0.21	3.8	0.74	72.5	O. D. : 6/4	9.0	Emmetropic	4 LH
																O. S. : 6/4	10.5	— .25 cyl. ax 90°	Add : Abd = 14 :9
		With glasses—Apparatus II.								With glasses—Apparatus II.									
W	25	3	77	42	119*[1]	0.09	1.02	0.46	1.48	0.39	61.9	0.07	...	0.46	45.1	O. D. : 6/6	12.0	+ .25 cyl. ax 0°	1½ Eso
																O. S. : 6/15	12.5	+ .50 cyl. ax 115°	Add : Abd = 20 :9
Bt	27	2	63	75	138*[1]	0.04	0.89	0.68	1.57	0.26	41.3	0.29	74.4	0.55	53.9	O. D. : 6/5+	9.5	— 3 S. — 1.37 cyl. ax 15°	Ortho
																O. S. : 6/5+	10.5	— 3 S. — 1.37 cyl. ax 165°	Add : Abd = 20 :9
H	31	1	105	43	148	0.02	1.17	0.405	1.575	0.54	85.7	0.015	3.8	0.555	54.4	O. D. : 6/4	9.0	— 1 S. — .37 cyl. ax 150°	¼ Exo, ½ RH
																O. S. : 6/4	10.0	— .25 S. — .25 cyl. ax 0°	Add : Abd = 24 :8
Hk	27	1	82	62	144	0.02	1.015	0.565	1.58	0.385	61.1	0.175	44.9	0.56	54.9	O. D. : 6/4—	11.0	— .50 S. — .25 cyl. ax 120°	¾ Eso, ½ RH
																O. S. : 6/5+	10.5	— .87 S. —.37 cyl. ax 60°	Add : Abd = 21 :9

[1]In the four cases marked with an asterisk, longer exposures were needed than could be gotten by changing the setting of the discs with a given position of the weights on the bar. The range of exposure needed was secured by changing the positions of the weights on the bar.

Under the age of 30, there seems to be no correlation in either group with the age of the observer.

So far but comparatively few observers have been tested above 30 years of age. The few that have been tested have averaged among the slowest of the normal group. We hope later to make a systematic study of the effect of age on speed of adjustment. In the present study our special purpose has been merely to find out whether individual differences of considerable magnitude are present well below the limit at which the influence of age might reasonably be expected to become effective.

There is a possible bearing of the principles of the test on the work of the clinic which perhaps should not be ignored. That is, in the conventional acuity test accuracy alone is taken into account. No provision is made in the form of the test to include speed of performance. When speed is added to accuracy as a requirement, a degree of sensitivity is given to the test which enables a much finer grading of the resolving power of the eye to be made. For example, two eyes which discriminate detail within the same visual angle can not be said to have the same acuity unless the task can be performed in the same or very nearly the same length of time; yet both might be given the same rating by the conventional test of acuity, so far as any safeguarding provision to the contrary is concerned.

Indeed, when speed is made a feature of the test, differences are picked up which would be passed over entirely by the clinic test. Such a refinement of the test need not be especially cumbersome when properly applied to the needs of the practitioner, and might, it would be reasonable to suppose, be utilized to advantage as a means of making a more precise diagnosis and in checking up and deciding between corrections, at least in certain difficult and troublesome cases.

From the beginning of our work with short exposures, results were obtained which may have some interest in relation to testing for astigmatism. For example, it was found that in certain cases there was a more favorable meridian for the quick discrimination of the test object. That is, when turned into this meridian, a shorter time of exposure was needed to give the judgment required, and small deviations on either side increased the time needed to make the discrimination. In case of my own eyes, for example, a difference in result amounting to 40 per cent was found for this meridian and the meridian at right angles to it. A deviation of 5 degrees either way from this most favorable meridian gave a difference in result amounting to 175 percent.

The astigmatism was so slight that it could not be detected on the astigmatic chart. It was located by means of the ophthalmometer. A +.12 cylinder served to make the time record equal for the two meridians and to eliminate the astigmatic showing by the ophthalmometer. On further study of several cases the test was shown to possess a pronounced sensitivity to astigmatism, even without any additional or special modification better to meet the requirements of that particular application. Some of the results of this study are shown in Table III.

The requirements of the apparatus needed to make the foregoing determinations are comparatively simple. Some means must be provided for giving the exposures to the near and far test-objects, which will immediately succeed each other in the required order, and which can be varied by very small amounts and be repeated with precision. The first of the above requirements can best be met by making the successive exposures all a part of the same system of motion. The simplest way in which all the requirements mentioned can be satisfied is perhaps to have the exposures made by a set of light weight discs, of variable open and closed sectors, turned by means of a bar fastened at its center to the axle to which the discs are attached, and provided with adjustable weights on both arms.

Such a system operates as a compound pendulum and has all the char-

TABLE III.

Showing a comparison of the time required to discriminate the far object in the most favorable meridian and the meridian 90 degrees from this in cases of low astigmatism—also the difference in the time required for the most favorable meridian and for meridians 5 degrees on either side.

Observer.	Refraction	Time of discrimination of far object in seconds: Most favorable meridian	At 90° removed from most favorable meridian	Difference for two meridians: Seconds	Percent.	Difference produced by a change of 5° in either direction: Seconds	Percent
R (O. S.)	— .25 cyl. ax 5°	0.70	0.95	0.25	35.71	0.09	12.86
R (O. D.)	— .37 cyl. ax 150°	0.96	1.40	0.44	45.83	...	....
F	+ .12 cyl. ax 120°	0.80	1.12	0.32	40.00	0.14	17.50
B	— .25 cyl. ax 150°	0.65	1.02	0.37	56.92	0.06	9.23
T	— 1.25 cyl. ax 170°	0.55	0.84	0.29	52.73	0.12	21.82
L	— .25 cyl ax 5°	0.76	0.88	0.12	15.79	...	....

1. Before the lag records are made it is recommended, of course, that astigmatism be corrected. However, even if they are not corrected, low astigmatisms will give little trouble unless the defect is in the same meridian in both eyes. There will then be more and less favorable meridians for the quick discrimination of the test-object. The difficulty can be overcome fairly well, however, and the record be made without serious injustice to the ranking of the observer by avoiding turning the test object into the most and least favorable meridians.

acteristics and constancy of motion of a compound pendulum. The length of exposure can be varied either by changing the width of the open sector or the position of the weights on the arms. By utilizing both of these variables to their fullest extent, changes can readily be made of the order of thousandths of a second or even less, and a total range of exposure can be given varying from these values up to several seconds. All our work was done, for example, by adjusting the position of the weights on the arms to give a slow rate of turning and changing the values of the open sectors. Constancy of rate of turning, and therefore constancy of length of exposure, with a given value of open sector and a given position of weights on the bar, was secured by always releasing the bar at the same point in the arc through which it makes its swing. On the back of each set of discs is a protractor or graduated circle by means of which the values of the open sectors can be read to degrees or fractions of degrees. These values in degrees for any number of observers or observations, if the discs are made of sufficiently light material, can be converted into units of time by a single process of calibration which will be described later.

In Fig. 2 is shown the first or simpler apparatus. The exposure discs, A, B, C, and D, are cut from hard sheet aluminum, No. 20 B. & S. guage. Each of these discs is cut as shown at X in the figure, the inner portion, radius 6.5 cm., solid; the outer portion open to a value of 172°. The breadth of this outer zone for discs A and B is 14.5 cm.; and for discs C and D, 22.5 cm. The difference in the breadth of these two sets of discs has to be such that the smaller will just cover one of the near test-objects, and the larger the other, the two objects being placed far enough apart in the same vertical plane to permit of a clear view between them with either eye of the far object.

All these discs are attached to an axle to the end of which is fastened the bar, 2.5 meters long, carrying the weights, M and N, which serve as the driving power of the apparatus. These weights are of equal mass, therefore the moment of turning of the system is governed, roughly speaking, by the

two factors: the combined distance of the two weights from the center of rotation, and the difference in the distance of the weights from that point, provided, as already stated, the swing is always begun at the same place in the arc thru which the system turns. To give stability of support, the axle turns in bearings at the ends of the two arms of a heavy Y-shaped support. A clutch, adjustable in height, supports the bar before it is released for its swing and guarantees that it always starts from the same position.

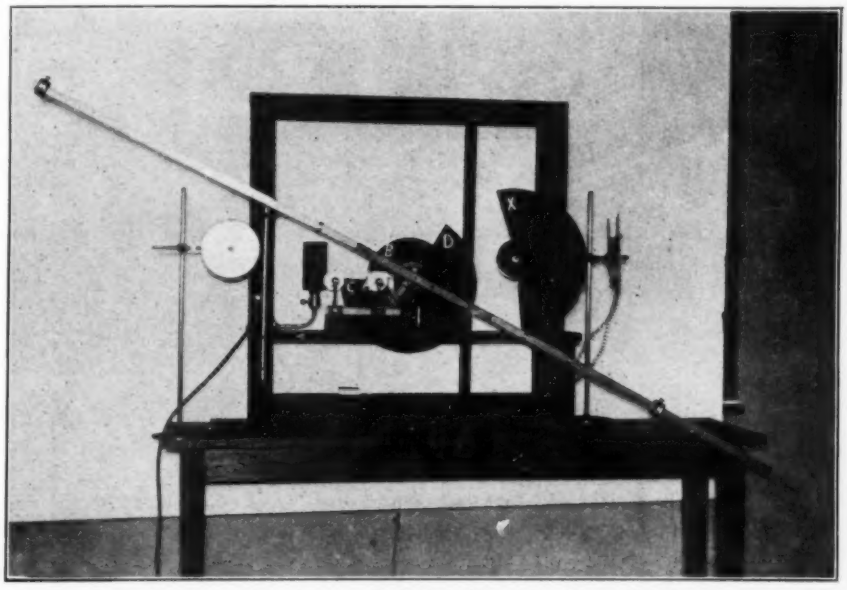

Fig. 2. Simpler apparatus for testing time required for adjustment of eyes for clear seeing at different distances. For explanation see text beginning page 772.

The discs A and C are pinned permanently to the axle in such a position that when the bar is held in the clutch, A just covers one of the test-objects and C the other. The discs B and D are free to turn about the axle, and when adjusted for a given value of exposure, are clamped in position by means of a nut and washer. Immediately in front of these discs are the two octagonal cards, along each edge of which at its exact center are printed one of the test-letters. These E's are so turned that by rotating the card the letters can be presented all precisely at the same place, pointing up, down, right, left, and the four corresponding 45° positions in any order that may be chosen.

The card itself is mounted at its center on a small metal disc at the end of a grooved pin 6.5 cm. long. This pin passes through a collar provided with a set screw, which feature permits of a certain latitude of adjustment of the distance of the test-card from the exposure discs. To provide for the rotation of the test-card this collar turns in a sleeve supported by a grooved carrier. This carrier slides on a track to permit of the needed latitude of adjustment of the test-object to right and left.

The far test-object is printed on a larger circular card which is mounted at its center on a small metal disc at the end of a pin which passes thru a broad collar permitting of its free rotation. At the other end of this pin is a pulley so arranged that, by means of two cords which thread thru a guide-ring 21 cm. below the center of the pulley, the card can be rotated to any position desired by the experimenter stationed at the exposure apparatus. The circumference of this card, which turns immediately behind a pointer, is graduated in degrees to

indicate the meridian into which the test-letter is turned. Between the observer and the exposure discs, as near to the discs as possible, is a cardboard screen with an aperture of such a height and breadth as to give a clear view of the near and far test-objects with either eye, and to cut off the rest of the field of view and the moving discs.

The near test-cards were illuminated by diffuse light reflected from the mat surface of the back of the cardboard screen between the observer and the exposure discs. The light was supplied by a tubular tungsten lamp enclosed in a cylindric housing provided with a vertical aperture of suitable breadth. This housing can be rotated about the lamp to give the proper angle of incidence of the light on the reflecting screen.

The far test-object was illuminated by a tungsten lamp mounted in an X-ray deep bowl reflector so directed as to give an even illumination of the test surface and to shield the eye from glare. All the test objects were brought as nearly as possible to a brightness and color match at a brightness value of 0.007 candlepower per square inch. The value of the illumination at the test-object was 5.2 foot-candles. The general illumination of the room was indirect, with an average value of 2.89 foot-candles, horizontal component; 1.11 foot-candles, vertical component; and 2.64 foot-candles, 45° component.

The experimental procedure was as follows: The three test-objects and the eyes of the observer were adjusted to the same vertical level, and the two near test-objects were separated far enough to give the observer a clear view of the far object with either eye.

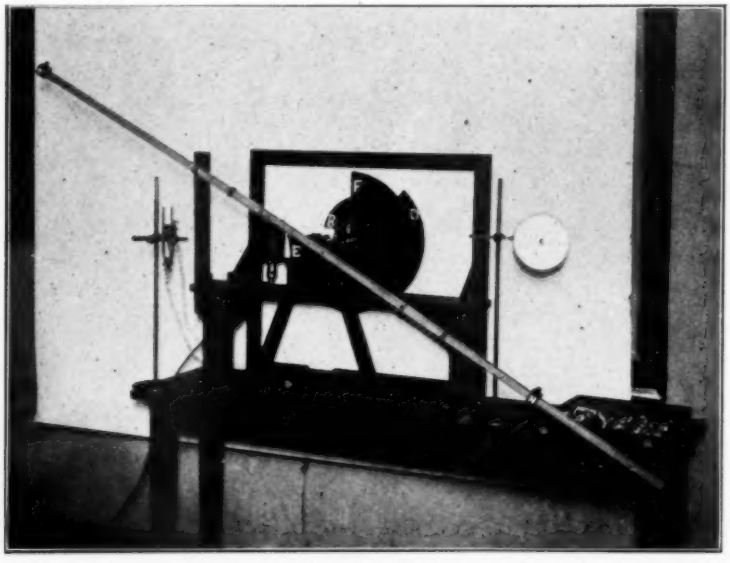

Fig. 3. Second form of apparatus for testing inertia of adjustment of eye for different distances. See explanation of Fig. 2 and also page 775.

Discs A and B were adjusted so as just to permit of the discrimination of the near object immediately in front of them; and C and D, the discrimination of the far object in case the time to pass from near to far is wanted, and of both the far object and the remaining near object in case the time of the double excursion is desired. In making each determination three correct judgments out of a possible five were required. A preparatory adjustment of the observer's eye was secured by having him fix a point on the discs in line with the near object first exposed and 3 mm. behind it. In order that the preparatory interval be as favor-

able as possible, the observer was required to give the signal for the release of the pendulum.

It should be noted in passing perhaps that the adjustment of the discs A and B is not made entirely or even primarily for determining the lag in perception with the eye in aproximate adjustment for the near object, although that is an item that might be of value in our comparative study of the lag of the ocular functions of different individuals. It has been made chiefly in order that the determination of the time to pass from near to far and back again to near shall be made with greater precision. That is, it is obvious that if the observer is to begin his excursion from near to far with an exact adjustment for clear seeing at near, it must be required as a check that he start with a task which involves a report of clear seeing at near.

The mere instruction to fix a point, for example, will not guarantee the needed adjustment. Moreover, it is equally obvious that the adjustment must be precisely controlled; if the results are to be safeguarded against the variable error that has already been discussed with reference to the exposure of the far object. That is, if it is not controlled, the eye may linger too long at near or begin too soon its change toward far; and the amount of deviation in either regard may vary from time to time and from individual to individual.

In the second type of apparatus (Figure 3) our purpose, it will be remembered, was to make it possible to do all that could be accomplished with the first apparatus, and in addition to provide for the separate determination of the time required to pass from near to far, and back again to near, in a single swing of the pendulum. In order to do this it was necessary to have behind the near test-objects a second set of discs attached to the same axle, one of the sectors of which, when properly adjusted, cuts off the far object as soon as it is discriminated. That is, in this apparatus the aperture of the two smaller sectors, A and B, of the nearer set of discs gives the time of perception of the near object on the observer's left; the aperture between B of this set and F of the farther set gives the time needed to pass from near to far; and the aperture between this disc and the disc D of the nearer set the time required to pass from far back again to near.

The other discs, E of the far set and C of the near set, are pinned permanently to the axle and are rigidly connected with the edge of each at exactly the same level. Both sets of discs are provided with graduated circles. At the edge of each of the moveable sectors are pointers for reading the values of the open sectors. As the apparatus now stands, the two sets of discs are both between the Y-shaped support and are only 10 cm. apart. Since the graduated circles are on the back of each set of discs, this makes the reading of the circle on the near set somewhat inconvenient. In a new apparatus now in construction the near set will be attached between the observer and the support in which the axle turns, and the far set beyond this support. This provision will give ample space between the two sets of discs for the convenient reading of the scale on the near discs.

Also in the newer form of apparatus the near test-cards are illuminated by a tubular tungsten lamp installed in the horizontal in a plane midway between the screen and the near test-objects, so that the center of its filament is about 12 cm. above the two test-objects and equidistant from them. The test-objects thus receive their light in part directly from the lamp and in part by reflection from the screen. In this way it is possible to make the intensity of light received by the two objects more nearly the same than is the case with the illuminating device shown in Figs. 2 and 3. On the platform between the two sets of discs is installed a second lamp, suitably shaded, which can be turned on and off at will for the reading of the graduated circle on the back of the set of discs nearest the observer. (Since the above paper was presented this newer type of apparatus has been taken

overseas for the purpose of studying and checking up the diurnal variations in the ocular condition of the aviators on the western front.)

With both types of apparatus, all readings are made in terms of degrees of open sector. These readings can, after any number of sets of observations, be converted into units of time by a simple process of calibration. Smoked paper is clipped to the disc across the open sector; the pendulum is released with the weights, the starting point, etc., just as they were in the original determinations; and a time line is run across the open sector by means of an electric tuning fork whose vibration frequency is known. The paper can be removed, shellacked, and counted at leisure. In counting, the given degree values can be laid off on the shellacked record by means of another protractor. If the discs are made of material (light cardboard, for example, instead of aluminum) so light that the different positions of the moveable discs do not change by significant amounts the relative accelerations of the pendulum at the different points in its path, a calibrating chart may be made once for all for the full range or any range of open sector that may be desired.

Another method which we have used is to have contacts soldered to the edges of the sector, in circuit with an electromagnetic time-marker writing on the smoked paper of a kymograph. Because of a certain amount of lag in this system of recording, the method was abandoned in favor of the one described. In practical use, however, where an exact quantitative rating of performance is not required, there is no particular need of converting the readings on the scale into units of time. This is especially true if the apparatus is used, as is the Snellen method of rating acuities, merely to classify performance roughly by the rank method. That is, in this case it is set to give in turn the different levels of performance chosen, and the eye is rated by the highest level which it is able to attain.

PERMANENT VASCULAR CHANGES FOLLOWING INJURIES TO THE EYE.

EDWARD JACKSON, M. D.

DENVER, COLO.

Report of cases of thrombotic obliteration of the choroidal vessels following trauma and avulsion of optic nerve; giving the ultimate results of such injuries. Read before the American Ophthalmological Society, July 9th, 1918.

The cases here reported have these points in common. In each there was a clear and definite history of severe injury to the region of the eye, followed immediately by permanent blindness. The nutrition of the eyeball remained good, and there was no obstacle to ophthalmoscopic study of the late results of the injury. In each case the vascular conditions found were of particular interest.

Case I.—M.B., a retired rancher, general health always good, aged 78, was struck on the right eye by a chip of wood 39 years ago, and from that time the eye was blind. There was no protracted or severe inflammation. Cataract formed, which was extracted 10 or 12 years later, without restoring sight. 1915, Dec. 27. The left eye had been losing its sight for two or three years. Vision was reduced to light perception, with good light projection, by senile cataract. In each eye there was an old non-vascular pterygium, extending 3.5 mm. on the nasal side of the cornea, which had probably developed before the injury.

The cataract was removed from the left eye by extraction with iridectomy.

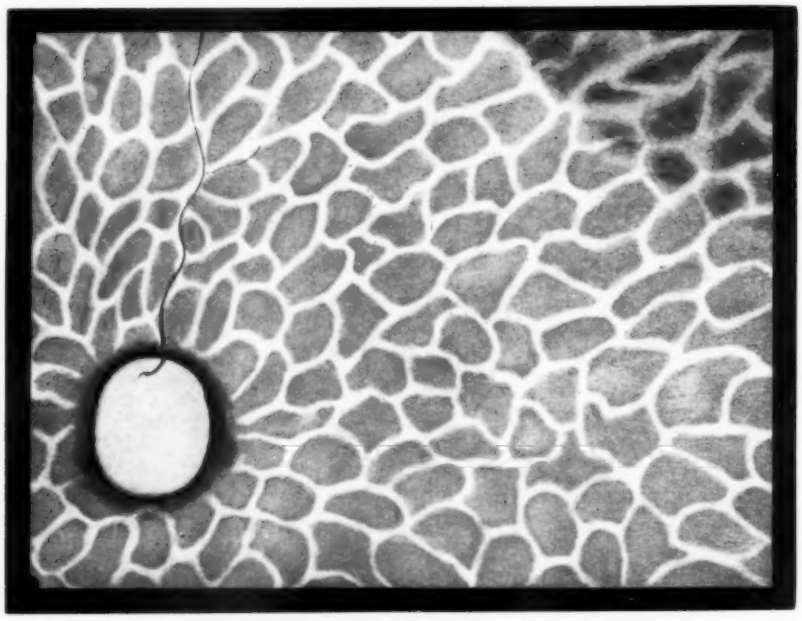

FIG. 1—OBLITERATION OF CHOROIDAL VESSELS

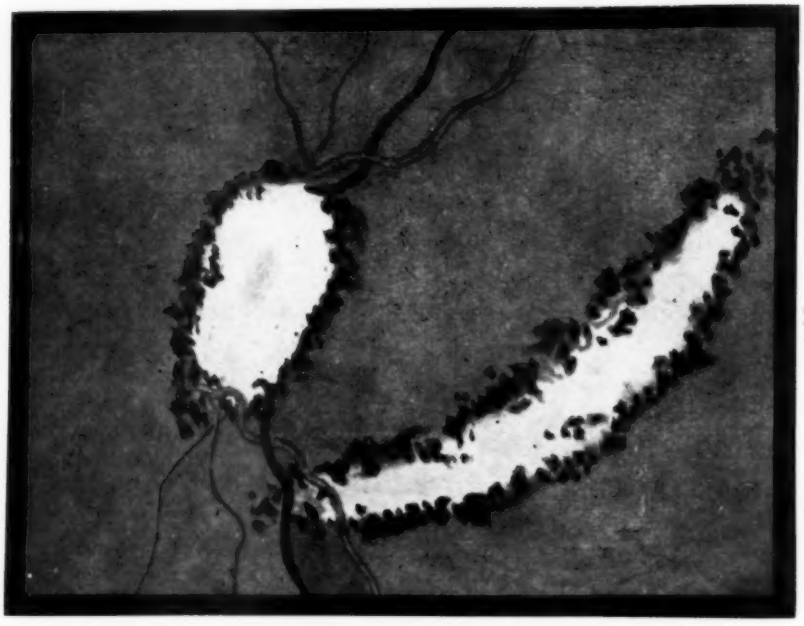

FIG. 2—AVULSION OF OPTIC NERVE AND RUPTURE OF CHOROID

Healing was uneventful. Corrected vision obtained was 0.7, with a + 12. sph. ⊃ — 3. cyl. axis 80°. The ophthalmoscope showed in this eye a normal fundus.

In the right eye there was an upward iridectomy, the crystalline lens was absent, the remaining capsule almost clear. The vitreous presented a few small opacities. The ophthalmoscopic picture is reproduced in Fig. 1. Plate XVII.

But one small retinal vessel was visible, passing upward. The optic disc was grayish white, and quite devoid of small vessels. Its margin showed a normal ring of pigmentation corresponding to that of the left eye. The whole central region of the choroid, extending from four to six disc diameters from the disc showed complete absence of retinal pigment and chorio-capillaris, and obliteration of the larger choroidal vessels. The latter were replaced by grayish white bands, sharply outlined by retained choroidal pigment. In the periphery of the fundus the capillary circulation of the choroid was present and seemed normal, and the larger choroidal vessels were normal in appearance, there being very little retinal pigment.

Case II.—B.W.G., attorney aged 36, good general health. When 7 or 8 years old was struck in the left eye with a pointed stick and has been unable to see with it since.

Right eye: Vision: 0.8 with + 0.62 ⊃ — 1.12 cyl. ax. 80° = 1.

Left eye: Vision: 0.012. Not improved by glasses.

Externally both eyes appear normal, except that the left diverged 50 to 55 centrads.

Ophthalmoscope: Right eye: Media clear, choroid slightly thinned and patchy. Disc slightly red and hazy, with small central physiologic cup.

Left eye: Dust-like opacities were found in the upper temporal part of the vitreous. Other parts of the fundus sharply seen. Retinal pigment layer and chorio-capillaris were completely atrophied except in the upper quadrant of the fundus. Bands of white tissue behind the retinal vessels are seen running from the optic disc to the extreme periphery, accompanying the upper nasal and temporal vessels; and a third linear band runs horizontally outward. Many of the larger choroidal vessels show the grayish-pinkish-white of choroidal sclerosis. The color shown in Fig. 1. There were many small pigment deposits in the retina, some in front of the retinal vessels, some branching like bone corpuscles, some rounded, most of them irregular in outline. The optic disc was red and slightly hazy. The retinal vessels were rather small especially the arteries; except upward where they were about normal. Above the disc the fundus was 2 D. myopic; in other directions it started with emmetropia at the disc margin, and became gradually more hyperopic, reaching 4 D. at the periphery of the visible fundus. Oblique illumination showed a linear Y-shaped opacity in the posterior nucleus or deep cortex, a fine gray line not visible with the ophthalmoscope. This eye had gradually diverged to 55 centrads. This was corrected by advancement with tenotomy. The healing was in all respects normal, and vision continues unchanged.

Case III.—J.O.E., a boy of 12, nearsighted since 4 years old, was knocked down by a cow three years ago. He was struck in the left eye which had been better than his right before that time. The lower lid was torn away except at the nasal end, the upper lid has drooped ever since. The eye was torn out of its socket, but was replaced by the physician who saw him at the time, and the wound stitched.

The left lower lid represents an inconspicuous scar extending 37 mm. down and out from near the everted lower punctum, and having three branches. The eye is about in normal position but is rotated down until the upper margin of the left cornea is about on a level with the upper margin of the right, when the right eye is in the primary position. The margin of the left orbit feels normal except the lower margin near the nose where it is irregular.

There is complete ptosis of the left eye but the palpebral fissure can be opened to full width with the fingers. It then shows about 5 mm. of cornea with the sclera above it. The extreme opening of the fissure by voluntary effort is about 4 mm. showing the upper 2 mm. of the cornea and 2 mm. of sclera. The eye can be turned up 2 or 3 mm. and laterally almost to the normal extent. Movements of the right eye normal. The left eye seems fixed by scar tissue, below, and back of it.

The pupils in fair light are: Right 3 mm., left 6 mm., in diameter. Movements of the right normal, left a sluggish consensual reaction, no direct reaction to light. Both dilate to 8.5 mm. with homatropin.

Right: Vision = 0.12, with $-$ 6 sph. $\bigcirc$ $-$ 1. cyl. axis 178° = 1.1.

Left: No light perception. 2 d. myopic.

The crystalline lens is in normal position in the left eye.

The ophthalmoscope shows the right eye, media clear, disk normal. Choroid rather light and patchy. Left eye: Media clear, the general appearance of the fundus resembles that of the right eye. The optic disc is replaced by an oval bluish-white area, vertically about one and one-half times the normal diameter of the disc in length, and the width of the disc, with brownish black pigment splotches all around its margin, which is a little irregular, as shown in Fig. 2, Plate XVII.

This space is slightly depressed, not over 1 D., and seems to be filled in with connective tissue. It is devoid of vessels. Retinal vessels about normal in size and appearance emerge at the upper and lower ends of this area. To the temporal side of the disc is a crescentic area presenting the usual appearances of so-called rupture of the choroid.

COMMENT.

These three cases take added interest when we compare them especially with regard to the points in which they differ. The striking thing in Case I is the almost complete disappearance of the retinal and choroidal vessels with complete absence of evidences of serious intraocular inflammation. The condition seems best explained by the hypothesis of injury to the vessels back of the eyeball causing complete thrombotic obstruction in the area of distribution for the posterior ciliary arteries; with preservation of the circulation in the region of the anterior ciliary arteries, as shown by the circulation, apparently normal in the anterior portion of the uveal tract. Along with the posterior ciliary, it is evident that the central retinal vessels had suffered and both had been obliterated except the single small branch extending upward from the disc, and its visible complementary vessels. We must conceive that from some source a diminished nutritive supply was kept up, sufficient to prevent tissue necrosis. But the anastomotic provision for this was too late or insufficient to reestablish any of the obstructed vascular trunks.

The picture of choroidal sclerosis, obliteration or atrophy of the larger choroidal vessels, or disappearance of the chorio-capillaris, is well known, and frequently alluded to in the literature, altho curiously any broad, complete account of the condition seems to be lacking. The allusions to it and descriptions of it are, perhaps, most numerous in Adam's *Ophthalmoscopic Diagnosis*. But almost invariably this condition has been confined to quite limited portions of the fundus, and evidently arose in connection with general vascular disease, or some local inflammatory condition. No case of such extensive vascular change, with so little evidence of other disease in the eye, following trauma seems to have been recorded.

Case II in contrast with Case I presented evidence of choroidal sclerosis in small areas, and obliteration of some of the vessels, while others were normal in appearance; the retinal circulation remaining practically normal. With these sclerotic changes were distinct evidences of severe inflammatory reaction. The white streaks behind the retinal vessels were such as would

be likely to follow extensive hemorrhage, and with them were associated pigment massings and atrophies that pointed to inflammatory reaction. These conditions were widely distributed but somewhat less pronounced than those shown in the plate accompanying an article by Hepburn.[1] This association of late effects of hemorrhage and inflammation we have all seen with the ophthalmoscope following trauma.

Case III must be regarded as one of avulsion of the optic nerve, partial or complete. It would be impossible to determine just how nearly complete it has been.

The reported cases of avulsion of the optic nerve fall naturally into two groups. In a larger number of cases the eyeball has been completely gouged out, or has hung by tissue that was promptly divided; or any view of the interior of the eye has been prevented by massive hemorrhage and subsequent opacity of the media. This case belongs with the smaller group, where valuable ophthalmoscopic observations have been possible, sometimes immediately after the injury, but generally after a longer interval. One of the most interesting of recorded cases is Lang's case[2] in a boy of 14, seen within 24 hours after the injury. Vision = 3/60. The upper half of the field of vision was gone, and at the lower part of the optic disc there was a black chasm, where the nerve had been torn loose. At the end of six weeks this chasm had filled in, the dark cavern being represented by a shallow white pit 1.5 D. in depth. Vision and the fields remained unchanged.

In the case reported by Salzmann[3] the ophthalmoscope showed at first a deep hole in place of the optic disc which seemed to fill from the bottom, and contract. Birkhauser's case[4] which was also caused by the horn of a cow, was seen the day after the injury. The horizontally oval optic disc was bounded below by a black crescent where a portion of the nerve had been torn loose. At the end of six weeks this was replaced by a white gray area, showing no parallax as compared with the optic nerve head. The field of vision remained unchanged. In other cases, first examined ophthalmoscopically at a later date, the appearances presented were similar.

Some doubt was raised, as to the reality of avulsion of the optic nerve in Case III, although the eyeball had been completely dislocated from the orbit, by the comparatively normal appearance of the retinal vessels seen above and below the filled in nerve entrance. But this comparatively normal appearance of the retinal vessels has been noted in the cases where the actual partial tear was seen immediately after the injury. It is quite striking in Lang's representation of the appearance at the end of six weeks. In Birkhauser's case the upper vessels might be regarded as normal and the lower vessels appear at the edge of the black chasm of apparently normal size, only each of the main branches becomes embedded in a large club-shaped hemorrhage.

In the case reported by Natanson,[5] which was seen two weeks after the accident occurred, with the cavity left by removal of the optic nerve partly filled in, the retinal vessels, not greatly altered in proportion, appear most of them at the margin of the cavity, as in my case.

In Parsons'[6] case of division of the optic nerve by a stab wound, while there was great edema of the papillomacular region resembling retinal embolism in the retinal vessels, altho pressure showed the blood in the vessels to be under reduced vascular pressure, they were of good size, the veins slightly larger than the arteries, and both were of nearly the same color, which resembled that of normal veins. Parsons suggests: "As soon as organization is sufficient to withstand the low venous pressure, the vessels will commence to refill thru the direct and the indirect cilioretinal anastomoses near the optic disc. These anastomoses are rather venous than arterial; hence the veins will fill up first. This is what we have seen actually occurs, and it takes place on the fourth or fifth day. The blood is, of course, de-

rived from the recurrent branches of the intact anterior ciliary arteries, and also from any posterior ciliary arteries which may have escaped section. The retinal arteries probably fill up first from the periphery, the blood trickling in the wrong direction from the already refilled veins."

Cases in which a histologic examination of the parts was made have been reported by Reis[7] and Liebrecht,[8] but their accounts throw little additional light upon the ophthalmoscopic appearances. The anatomic conditions of recent rupture of the choroid have been observed by Alt.[9]

In every serious injury to the vessels, thrombosis is a first step in the process of repair. In the vessels of the eyeball and orbit it rarely extends sufficiently to increase the damage done by trauma. In the majority of cases it helps to secure reestablishment of the circulation. But it may become a factor in extending the damage done within the eyeball, as has occasionally occurred in the orbit following injections of paraffin into the tissues, or injections in the region of the lacrimal sac. It might be well to consider this even in connection with operative trauma.

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UNRECOGNIZED CHRONIC SIMPLE GLAUCOMA.

EDWARD J. BROWN, M. D.

MINNEAPOLIS.

A report of cases showing the association of eye strain and noninflammatory glaucoma.

In a paper with the above title read by me at the Pittsburgh meeting of the American Academy of Ophthalmology and Oto-Laryngology in October, 1917, I presented clinical evidence in favor of the following propositions:

1. Simple glaucoma is the result of eye-strain as shown by the fact that women suffer more frequently than men, and that dressmakers and seamstresses suffer more frequently than other women.

2. The writings of Priestley Smith and Samuel D. Risley show by implication that the dividing line between myopia and simple glaucoma is largely an imaginary one, depending upon the greater or less degree of resistance of the fibrous envelope of the eye.

3. Intraocular tension is relative, and the tension that is sufficient to cause stretching of the fibrous coat of the eye is probably sufficient to cause damaging pressure at the same time upon the optic nervehead and upon the delicate structures of the ciliary region, and with a more resistant sclera the latter effects will be the more in evidence.

4. Numerous cases are constantly passing thru the hands of ophthalmologists as simple refraction cases, which present more or less of the following conditions: Engorgement of the episcleral vessels, unequal tension, subnormal sensibility of the cornea, shallow anterior chamber, paleness and concavity of the temporal disc, con-

traction of the visual fields, especially for colors, and enlargement of the blind spot of Mariotte.

The following cases have especially interested me as further evidence in that direction:

Case 1.—Dr. R., 70 years of age, consulted me in 1914 for an aural trouble. I had known him for many years and had noted in former years that his eyelids were congested. He once in the absence of his oculist asked me to prescribe for some acute condition of the lids. I found he was wearing sphericals for reading and suggested that he ask his oculist to give him a correction for his astigmatism, which was later done. In March, 1915, I noticed a slight dilatation of his pupils and suggested an examination of the eyes. He was wearing from his former oculist: R. and L., each +0.75 ⊃ +0.50 C. axis hor. with a presbyopic correction. My findings were as follows: R. +0.62 cy. ax. 180° = 20/15. L. +1.25 +0.87 cy. ax. 177° = 20/15. The temporal discs were slightly cupped and the relatively enlarged veins in places obliterated by the crossing of the arteries. Tension seemed normal to the fingers. Either because of my remissness, or because the patient was a physician, the fields were not taken. In November, 1915, there was some discomfort in reading and a slight increase in the astigmatism. Corrected vision: R. 20/20 and L. 20/15.

On the 17th of January, 1916, tension seemed slightly plus. The tonometer registered 30 mm. of Hg. in each eye. There was marked contraction of both form and color fields, the former mostly inside fifty degrees. Under 1 per cent pilocarpin muriat t. i. d. one week later the tonometer registered 19 and 25 mm.

He returned in November, ten months later (for his ears). His astigmatism was slightly greater in the right and less in the left eye. He had long since discontinued the pilocarpin. Tonometer 20 mm. Vision good; but the fields markedly contracted, for white mostly inside thirty degrees. The pupils were slightly dilated. He was urged to be faithful with the pilocarpin. In June, 1918, vision is normal, the form fields have returned nearly to the normal, tension was normal and both discs slightly concave, the right entirely and the left only the temporal half.

Case 2.—W. E. N., 62, (case of Dr. Charles Nelson Spratt) consulted Dr. S. on the 12th of December, 1917, complaining of steamy vision of R. No history of pain. V., R. 5/12 plus, +1.25 = 5/6 plus. V., L. 5/12, +1.75 ⊃ +.50 cy. axis, 120° V. = 5/4. R. cornea hazy, pupil dilated, disc not cupped, tonometer 43 mm. Hg. L. cornea clear, tonometer 17 mm. Hg. December 19, after use of miotic, R. cornea clear, tonometer 36 mm. December 26, tonometer 25 mm. January 16, V., R. +1.25 = 5/5, tonometer, both normal. March 11, V., R. +1.25 = 5/7. Tonometer 21 mm. April 8, V., R. +1.25 = 5/200. Tonometer 51 mm. April 9, Lagrange operation. April 22, eye white. April 29, V., R. +6. Cyl. axis 15° = 5/30. I had had the pleasure of seeing the entirely smooth operation, and on May 14, Dr. Spratt had the kindness to bring the man to my office. The operative result seemed ideal, a fine large bleb over the iridectomy, but vision was =5/200, the swollen lens afforded no view of the fundus details, and the tension was 48 mm. Hg. I found a moderate temporal cupping of the left disc, and the same had probably been the case with the right.

Case 3.—M. A. S., 44, bookkeeper, came to me in 1910 with the complaint of misty vision especially of horizontal lines. V., R. and L., 20/20+. She had not worn glasses. Her quarter diopter of astigmatism was corrected, and 1 D. presbyopic correction added. There were also L. H. 1/2°, Exoph. 2° and abduction 9°. In 1914 2 D. presbyopic correction was given.

In January, 1918, she complained that vision had been bad for two months. She accepted an addition of a half diopter sphere to the distance correction, which gave V., R. 20/30, L. 20/30. A presbyopic correction of 2.50 D. The anterior chambers were

shallow, the irides dull, the pupils sluggish, temporal discs 2-3 D. concave, tension apparently normal, the fields for white contracted from ten to twenty degrees, for red mostly inside fifteen degrees. Each blind spot of Mariotte at 2 meters is 35 cm.

She was given a 1-24,000 solution of eserin sulphat for use four times daily She has a moderate sized goiter and for the nervous symptoms was given 2 grains t. i. d. of hydrobromid of quinia.

On July 31, Miss S. complained of having more or less pain in her eyes. 20/15. I had not seen her again till Aug. 1 of this year, when she came with the complaint that she had foolishly looked for some moments at the solar eclipse of June 8 without a protecting glass, since which her vision had been bad. The dark spots of which she had complained had gradually disappeared but the eyes remained weak. No scotoma was demonstrated in either eye, vision with her glasses was 20/30, and could be only slightly improved by the addition of +0.12 cyl. The corneas were 12 mm. in diameter, subnormally sensitive, the anterior

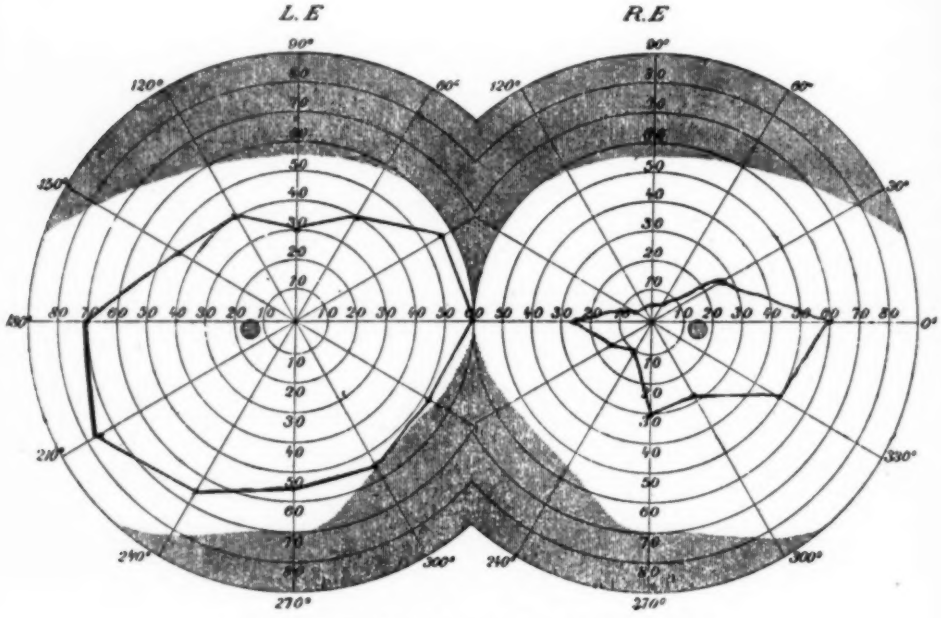

Fig. 1. Fields of vision in Case II, taken April 8th, 1918.

She accepted the following: R. +1.75 +0.25 c. 45°; L. +1.50 +0.25 cy. ax. 90° = 20/15. Evidently a cycloplegic should have been used years ago. I neglected to say that her exophoria at 13″ is now 16°, an element of eyestrain of no small importance.

Case 4.—Miss E. B., 31, stenographer, wearing +0.75 cy. axis 90° from an optometrist, consulted me in 1910 for pain in her eyes. Under scopolamin the addition to her correction of plus 1.50 spheres gave vision of chambers shallow, tension apparently normal, the temporal discs about 2 D. concave, the blind spots of Mariotte at 2 m. 27 cm.; and both form and color fields defective, especially the latter. Miss B. was given eserin sulphat solution 1-24,000, one drop to be used in each eye at bed time. The following morning she reported the eyes feeling better than for a long time, and the corrected vision of each eye was 20/15. The addition of +0.75 D. gave Jaeger 1 at from 10° to 18°.

Case 5.—A. B., 61, attorney, alcoholic and impecunious, came to me in 1905 with the complaint that for two years he had been inclined to miscalculate distances on going up or down stairs; and for a year and a half had noticed growing failure of the vision of the left eye. No pain or other symptoms. The eyes were large and prominent, the cornea 12 mm., anterior chambers rather deep, tension not noted, probably appeared normal. The right optic disc was slightly cupped in the temporal half, the left rather deeply in its whole extent, with undermined edges. V., R. 20/20, +0.50 cy. axis 90° = 20/15. The left eye could not count fingers. The right field for white was normal, the left field was limited to the temporal, outside fifteen degrees from the center.

Eight years later, in 1913, he returned for a change of lenses having had no treatment in the interval. Tension seemed slightly plus in both eyes. The left field was limited to a small paracentral area 30x20 degrees, the right form field still normal, color fields not taken. V., R. +0.75 ⌒ +0.25 cy. axis 60° = 20/15. One year later a quarter diopter addition to the cylinder and a slight change of axis. Vision=20/20.

In 1916 B. concluded to settle down to business and have the remaining eye cared for. In May the right field contracted from 20 to 30 degrees, the horizontal diameter of the blind spot 31 cm. at 2 meters. Tension clearly plus but no complaint of pain, tonometer 30 and 80 mm. of Hg. After a few days' use of a weak solution of eserin the tonometer registered 22 and 35 cm. Hg. In April, 1917, under the use of 1-12,000 solution of eserin, the pupils were slightly dilated and vision —20/30, tension plus and the field mostly inside of 40°, the defect on the 60th meridian reaching within five degrees of the center. The blind spot was 35x50 cm. at 2 meters. Under a 1-6,000 solution the eyes became softer, and in June the paracentral defect had disappeared and the field was concentrically about 35°. In August, 1918, corrected vision is = 20/20, fields and objective conditions much the same as one year ago.

NOTES, CASES, INSTRUMENTS

PARALYTIC STRABISMUS CURED BY SIMPLE OPERATIVE PROCEDURE.

DR. JESSE S. WYLER.

CINCINNATI, OHIO.

On February 10th, 1917, a baby of eleven months was brought to my office by the mother who was greatly perturbed by the prognosis of an eminent ophthalmologist regarding the sight of her child. This physician had informed her that the brain of the child had been damaged by a prenatal hemorrhage, that part of the face was palsied, and a great part of the sight of the remaining good eye had been destroyed.

The patient was a fat healthy baby, of grotesque appearance due to a convergent strabismus of the left eye of nearly 45°. This ocular deviation had existed since birth. The child made no effort to turn the left eye toward the temple and when the right eye was turned nasally the left never moved past the median line. Dilation of the pupils with atropin 1 per cent, showed that the ocular media were clear. The disc of the right eye was apparently normal surrounded by an area of choroidal atrophy. Above the disc was a coloboma of the choroid about the size of ten papillae. The left fundus seemed normal, with possibly a patch of pigment below the disc. As the ophthalmoscopic picture in eleven month babies is not very steady, a more careful study could not be made. The vision seemed good for each eye tested separately with small marbles.

A diagnosis of strabismus due to palsy of the left externus with contracture of the left internus was made. I first attempted to apply the simple measures of conservative treatment, instilling atropin in the good eye and also using a cover pad. These, as may be expected, proved worthless as the child was unable to rotate the left eye.

In October the mother began to insist that something radical be done. Never having performed a muscle op-

Fig. 1. Result of operation for paralytic squint. (Wyler.)

eration on a baby so young, and altho feeling rather dubious about the results, I decided to tenotomize the internus of the squinting eye, expecting to either advance the paralyzed muscle at some future date or to perform a tendon slip transplantation. The mother was told not to expect a great change.

On October 21, 1917, under a general anesthetic a complete tenotomy of the internus was made. A double armed silk suture was then passed close to the temporal side of the limbus, taking a good grasp in the conjunctiva and upper scleral layers and brought thru the skin of the temple. Upon tying this supporting suture, the eye rotated to the outer angle. This supporting suture was allowed to remain "in situ" for three days. Upon its removal, the eye turned back to the median line, and since that time we have succeeded in exercising the lateral motion to the left by constantly attracting the patient's attention to that side. The eyes now are in perfect position with a fair action on the part of the externus, altho the patient still has a slight compensating twist of the head when looking toward the left. No secondary operation will be necessary and the latest photographs are those of a child with perfect orthophoria.

The marvelous end result in this unfavorable condition is my excuse for this report.

THE RELATION OF LUES TO OCULAR PATHOLOGY.

Capt. James M. Blackwood, M. D.

Publication authorized from office of Surgeon General U. S. A.

Much has been written on the relation of lues to ocular manifestations. Massive evidence must yet be accumulated both to substantiate and disprove theories now in vogue. In presenting the following observations, the writer does not pretend to claim either the foreword or the last verse of the tragedy. Were these findings to be considered a small link in the mighty chain which will be woven as the experiences of others will be contributed, our work will not have been in vain. The vast wealth of clinical material at Camp Sevier stimulated the gathering of these facts. Eight hundred and thirty cases were observed, when presenting themselves at the eye dispensary, among which 36 were proven to be syphilitic. Of the 36 cases, 14 suffered with demonstrable ocular pathology. Of the different ocular mani-

festations, the following classifications were made:

1. Optic Neuritis—4 cases. Three of these denied infection, both by name and symptom, but with positive laboratory reactions. One of these gave positive history dating back two years.

2. Choroiditis—3 cases. Two gave positive histories dating back two years. One gave positive history dating back ten years.

3. Neuroretinitis—2 cases. One denied syphilis by name and symptom, but with positive laboratory findings. One gave positive history dating back two years.

4. Argyll Robertson pupillary reaction—2 cases. Both denied infection by name and symptom. Both had positive laboratory findings.

5. Iritis—2 cases. Both denied infection by name and symptom. Both had positive laboratory findings.

6. Disciform Keratitis—1 case, who gave a positive history dating back six years.

The ages of those having definite pathology ranged from 20 to 38 years. The two cases having tabetic symptoms were 26 and 28 years respectively.

Of the 36 cases listed, 8 who manifested no pathology at first visit, failed to return for further observation.

SUMMARY.

1. Four and three-tenths per cent of series of cases presenting themselves at the eye dispensary for ocular symptoms were syphilitic.

2. Thirty-eight and eight-tenths per cent of those having positive luetic findings manifested ocular pathology.

3. Deducting the 8 cases not fully investigated, 50 per cent of all luetics had positive ocular pathology.

4. Fifty-seven and one-tenth per cent of those manifesting ocular pathology denied lues by name and symptom, even when confronted by positive laboratory evidence.

5. Twenty-eight and five-tenths per cent of the pathologic group manifested optic neuritis as the first luetic symptom.

6. Tabes first manifested in ocular symptoms and in early life.

INFANTILE DACRYOCYSTITIS.

FREDERICK T. CLARK, M. D., F. A. C. S.

WESTFIELD, MASSACHUSETTS.

Cases of occlusion of the lacrimal ducts, or of occlusion with infection of the sacs in the new born are so unusual that I am reporting this case which has recently come under my observation.

On July 21, 1918, Dr. George H. Janes asked me to see an eight days old child who had developed a purulent conjunctivitis. The child was born in the obstetric department of the Noble Hospital. The mother was a primipara and the delivery was made with the aid of instruments with no injury to mother or child.

From birth the nurse noted a puffiness or swelling in the region of the left tear sac but it was not until the fourth day that pus was noted in the child's eyes. The eyes were flushed with boric acid solution frequently but the pus increased in amount and I was called on the eighth day.

The lids of both eyes were much swollen and on being separated golden yellow pus poured from between them. The left tear sac was tense and swollen and distinct fluctuation was made out. There was some swelling in the region of the right sac but no fluctuation. My diagnosis was ophthalmia neonatorum with infection of the lacrimal sacs.

This diagnosis was apparently confirmed by the bacteriologist's report, Dr. Fred D. Jones, who reported the presence in the smear of gram negative diplococci both intra- and extracellular, also gram positive cocci showing a mixed infection. The diplococci he took to be gonococci but did not differentiate them from catarrhalis cocci by cultural methods. The subsequent history of the case leads me to believe the infection was not gonorrheal.

The swelling and tenderness of the lacrimal sacs increased and on the next day—the baby being nine days old, the left sac was freely incised and a large amount of very yellow pus evacuated. The incised sac was flushed frequently thru the incision with boric acid solution with the result that in twenty-four hours the swelling of the left eye was markedly reduced and but a scanty amount of pus was present in the eye.

The right sac was following a similar course and two days after incising the left sac the right was given similar treatment, and the mother allowed to go home with her baby. At home the sacs were irrigated through the incisions with boric acid solution from a dropper every six hours. In two days all pus disappeared from the eyes and all swelling had gone. The incisions into the sacs were allowed to close but in forty-eight hours had to be reopened and irrigated again. The sacs were kept open and irrigated every six hours till the baby was nineteen days old. Then each capaliculus was incised the smallest possible amount to allow of the passage of a No. 2 Bowman's probe followed by syringing through the canaliculus. In probing it was noted that the lacrymo-nasal ducts were extraordinarily large.

Assured the ducts were patent the sacs were kept open and irrigated for two more days. Then the right sac, because it was cleanest was allowed to close. It received no further treatment. The left sac was still secreting some pus. The duct was again probed and syringed and two days later the sac had so cleaned up that it was allowed to close. The contents of the sac were expressed into the nose by finger pressure for a few days and no further treatment was required. My last note on the case made when the child was thirty-three days old and when it passed from under observation reads: "August 15, 1918. No fullness over sacs and both lacrimal systems apparently functioning normally. Discharged."

I do not look upon this as a case of ophthalmia neonatorum with infection of the lacrimal sacs. In the light of later developments in the condition of the eyes I believe this to have been a condition of congenital obstruction of the lacrimal ducts. It is probable that the lacrimo-nasal ducts were not fully developed. If developed they were glued together or occluded by a plug of material which normally exists during fetal life and which had not become absorbed. The undrained sacs acted as ideal culture media for pus-producing cocci that are normally present in the birth canal of every woman. Furthermore the quick clearing up of the infection argues against its gonorrheal character.

In the article in the American Encyclopedia of Ophthalmology on Infantile Dacryocystitis the view above expressed is supported by such authorities as Jackson, Gunn and others.

SOCIETY PROCEEDINGS

AMERICAN OPHTHALMOLOGICAL SOCIETY. — FIFTY-FOURTH ANNUAL MEETING.

NEW LONDON, CONN.,

July 9 and 10, 1918.

President, Dr. WILLIAM H. WILDER, CHICAGO.

(*Continued from page* 732)

Permanent Vascular Changes Following Injuries.

Dr. EDWARD JACKSON, Denver, Colorado, read this paper, published in full, page 776.

Avulsion of the Optic Nerve.

Dr. EUGENE M. BLAKE, New Haven, Conn., reported a case of such injury. A man aged 29 was thrown from a wagon, striking his head in such a way that the superior maxilla was fractured and loosened; and the nasal bones separated from their attachments. The left eye, being ruptured and protruding, was enucleated at once. There was also immediate blindness of the right eye, with pupil dilated and immobile. In place of the optic nerve head, the ophthalmoscope showed a deep cavity. The retinal circulation was lacking except in the lower part. The right globe had evidently been forced so far forward that the optic nerve was stretched to the limit, and torn from the eyeball.

Optic Neuritis and Irido-cyclitis from Disease of Tonsils.

Dr. HOWARD F. HANSELL, Philadelphia, Pa., read a paper reporting two cases in which these ocular lesions were dependent upon disease of the tonsils. One patient suffered from acute double optic neuritis and complete transient blindness. Suppurating tonsils were removed, and within twenty-four hours light perception returned. It slowly improved until at the end of one year vision equalled 4/5. But both optic disks showed partial atrophy.

In the second case, chronic irido-cyclitis had continued for three months, with acute exacerbations. After tonsillotomy, recovery commenced within a few hours; and was rapid and complete.

Septic Retrobulbar Neuritis, Blindness

Dr. WALTER E. LAMBERT, of New York City, reported the case of a woman, aged 64, who had suffered many years with severe headache; but had been relieved by correction of a low hyperphoria. He assumed that the etiology of her more recent trouble was infection from disease of the adjacent sinuses; and in this opinion the ophthalmologist who saw the case with him concurred. There was, however, a different opinion held by the attending physician and the rhinologist. The intensity of the inflammation, the sudden onset and the lateness of the ocular complications, after the patient had been suffering a long time with general toxemia, seem interesting.

On March 27, 1917, she reported having intense headaches. She had been treated for neuritis and a general variety of ailments. The eye condition seemed unchanged. An X-ray examination of the sinuses disclosed the right antrum seriously involved, and a portion of the root of a tooth in the cavity. After operation for this, April 6th, the headaches subsided somewhat, but a slight septic temperature continued. May 7th, blurring of vision of the left eye occurred. Examination the next day showed no light perception. There was a marked papillitis, arteries small; and sluggish, segmented circulation in the veins. Right eye unaffected. Dr. J. E. Weeks agreed that there was a partial occlusion of the central artery of the retina.

On May 10th, the vision of the right eye became affected, with evidence of obtruction of the central artery of the retina. Dr. Weeks again saw the patient, and agreed that an immediate operation upon the ethmoid cells should be done. The operation was deferred. The next day an X-ray

showed no evidence of sinus involvement. On the same day the patient was seen by Dr. Arnold Knapp. Vision had slightly improved, but there was a distinct central scotoma for form and color, tenderness on pressure, and some pain on movements of the eyeball, unmistakably showing an acute retrobulbar neuritis. Vision of the right failed rapidly, and on May 15th the patient was absolutely blind. Total atrophy of the optic nerve followed.

DISCUSSION:—Dr. Edward A. Shumway, Philadelphia, Pa.: Focal infection, as the cause of organic disease of the eye, is becoming an increasingly important factor in our work. I desire to place briefly on record two interesting cases:

The first patient was a woman, twenty-eight years of age. The left eye had become painful ten days, and there was severe pain in the left side of the head. Vision became blurred, and in a few days the eye was totally blind. While not in perfect health, there had been no distinct illness, barring an attack of diarrhea with pain, the week preceding the eye attack.

The left eye had no light perception, and was painful on movement; and the ocular rotations were somewhat limited. There was no pupillary response to light. The ophthalmoscopic examination showed slightly blurred margins and full veins, but no distinct neuritis. The right eye had 6/5 vision; and normal movement, visual fields and eye grounds. No metabolic disturbance was found, the urine and blood were normal, the Wassermann test negative. The nasal sinuses were free from trouble. A suspicious tooth had its filling withdrawn, but no pus was discovered.

The patient was vigorously sweated and purged and given bichlorid of mercury at first. Later, inunctions of mercury were employed, iodides and strychnia, and the galvanic current. Nearly four weeks after the first visit she claimed she could see hand movements. But not until thirty-six days from the time of complete blindness, was there true light perception, and return of the pupil reflex. Slowly vision improved, from hand movement perception to 6/6. The nerve became moderately atrophic.

The field of vision was very interesting. A small central area of vision first returned, as shown by the fields taken at the time. This gradually widened, especially on the temporal side, and later a patch appeared on the nasal side, but was eventually blotted out.

On the recovery of vision a left hyperphoria of 8°, and an esophoria of 18° was found; showing that there had been an involvment of nerves controlling the ocular muscles, together with the fifth nerve, at the apex of the orbit. Two and a half years later vision was still 6/6. Later an attack of uveitis occurred in the other eye, at which time a wisdom tooth, which had been causing trouble was extracted, with immediate improvement.

The second case is that of a man 78 years of age, whom I saw first May 23, 1918. Nine days before, while in good health, he was seized with severe pain in the top of the head, which later became localized in the left eye. Three days later, diplopia appeared; three days after that, sight failed, and for two days the eye had been blind. There was no light perception, or pupil reaction. The eyeball did not move outward beyond the median line, and its movements upward, inward and downward were greatly restricted; the lid was partially ptosed. The eye ground was quite normal, the nerve head was not blurred, nor were the vessels altered. The right eye had normal vision, and was normal.

A diagnosis was made of periostitis of the apex of the orbit with involvement of the optic nerve, and the third, fourth, fifth and sixth nerves. Other examinations revealed nothing abnormal; but X-ray examination of the teeth revealed abscesses at the roots of each of five remaining stumps, and these were promptly extracted. After treatment with mercury and iodid, and sweating in an electric cabinet, movement of the eyeball began to improve, and all pain disappeared. But up to June 26th, there had been no return of vision.

Both cases represent types of acute retroocular inflammation of the optic nerve, due to an inflammation at the apex of the orbit. Such cases have been ascribed to catching cold, but all such cases should be studied, for the presence of focal infections, and these carefully eradicated.

In all cases of acute retrobulbar neuritis, the possibility of a late appearance of multiple sclerosis should be considered. I have already placed on record such a case, which commenced as a unilateral neuritis, due apparently to ethmoidal sinus empyema; and with Dr. William G. Spiller, I am studying a very similar case at present in which the teeth were at fault. I feel that multiple sclerosis, in which we have multiple inflammatory foci scattered through the central nervous system, may originate in a focal infection in the teeth or sinuses, a view which has been corroborated by Stark of Texas, and by Billings and Rosenau, of Chicago.

Dr. William A. Shoemaker, St. Louis, Mo.: We must not forget the possibility of the direct spread of the inflammation through the nerve by means of perineuritis. This would cause an interstitial neuritis and affect the vision; for in these cases we should expect to find a peripheral concentric contraction of the field of vision, which, indeed, has been found in the cases of sinus involvement. Compression of the retinal vein at its exit from the nerve trunk has been suggested as an explanation of this condition.

I desire to report a case of large central scotoma caused by hyperplastic sphenoiditis, in a man thirty years of age, in which I believe the affection of the optic nerve was by the action of the toxin on the nerve fibers. He had, three weeks previously, observed that his vision was so dim that he could only get around with difficulty. The ophthalmoscope showed clear media, but low-grade inflammation of the optic nerves in both eyes. The chart of the fields showed some concentric contraction of the fields. Color perception in the right eye was limited to 5° from the point of fixation.

In the left eye, the color perception was indefinite, so that he was never certain about any color. There was a marked central scotoma. He stated that he had never used tobacco or alcohol to any extent. A rhinologist reported that he had a marked hyperplastic sphenoiditis. The Wassermann was negative. The rhinologist operated on the left side, and no improvement of vision followed the operation. Vision began to get worse in the right eye, with central scotoma. Four weeks from the first operation, the right sphenoid was operated on.

A month or so after the second operation, the central scotomas were considerably diminished. Five months after the first visit, vision was only about five or six two-hundredths, and he still had the central scotoma. I believe the poison generated in the hyperplastic sphenoiditis was responsible for these large central scotomas.

Dr. John E. Weeks, New York City: In the case Dr. Lambert reported; at first the optic nerve on the left side was slightly pale; the outlines, a little indistinct, the arteries, small; and the veins, showing a segmented circulation. With this was a history of pus having been found in the antrum. When I saw the case a second time, the arteries on the left side had not increased in size, the veins were still small. The sudden loss of vision with this appearance of the background was, to me, a picture of interruption of the circulation in the central artery of the retina.

The question was whether it was simply from pressure, from spasm, or from a thrombus; but, to me, the most plausible explanation was a thrombotic condition due to the absorption of toxins. I recommended free opening of the sinuses, as it seemed evident that it was a septic process. In the second eye, the appearances were almost similar to those of the first. I was very insistent in my advice to make drainage from the accessory sinuses free, but was overruled. Dr. Lambert concurred in my suggestions. The outcome was complete blindness.

I have at present under observation a case in which the vision was reduced to 6/60, apparently from a sphenoidal sinuitis. The vision three weeks later

is 20/20 minus, from effecting free drainage of the sinus on the right side.

Dr. G. Oram Ring, Philadelphia, Pa.: Eight weeks ago I saw a student in the University of Pennsylvania, twenty years of age, splendidly developed, supplementing his regular studies with a military course. Up to two weeks before, he had been regarded as a crack shot in his class. Then he began to fall down in his shooting, and concluded that it was due to blurring of the right eye. His left was normal, but his right had dropped to 20/40. There was a definite posterior hyalitis. It was found that there were two possible sources of trouble: One, in the intestinal tract; and the other, in the tonsils. His tonsils, he had never complained of. But there were half a dozen crypts that evidently had cheesy exudative material in them. The intestinal condition was promptly treated. Iodin and thyroid were given internally, and each crypt was carefully and repeatedly cleansed with iodin and alcohol. The improvement from 20/40 was noticeable promptly, to 20/20 at the end of four or five weeks.

The fundus had not cleared, but was definitely improving. For two or three weeks, there was no improvement that I could observe. It then occurred to me that a more accurate investigation of the condition of the tonsil should be made. It showed an amount of cheesy material in the interior. Having eliminated an intestinal condition, I believe that there is nothing left to be done but a prompt removal of both tonsils, which will be done.

Dr. T. Y. Sutphen, Newark, N. J.: About six months ago I saw a case of optic neuritis of one eye; and, with the X-ray photograph, ethmoidal trouble was found on that side. The ethmoid was operated on, and the patient made a rapid recovery; altho the vision had been almost nil before the operation.

Dr. Hiram Woods, Baltimore, Md.: Among cases I reported to this society three years ago was that of a lawyer in Baltimore, who had developed a double uveitis, involving almost the entire tract, with typical symptoms. All the clinical investigations were negative, except that at the root of a tooth, there was found a suspicious appearance, and the tooth was extracted. As soon as fresh tissue was opened up by the extraction, the man went blind. He had to be led to the hospital. His vitreous became so dense that the fundus could not be seen. After the ordinary treatment with sweats, etc., for three or four days, it began to clear up. When the case was reported vision was 20/40.

He subsequently had a relapse, and the right antrum was opened. The left was found normal. He continued to get not much better. A rhinologist found the left antrum involved, and that was drained. He came back somewhat improved, but not very much. Since then, he has developed the old intestinal condition, and the tooth condition. He has had both antra drained, had teeth extracted, had an ethmoidal operation done, and finally has undergone a mastoid operation. He stood them all, and now has V = 20/20 in each eye. This ran over a series of years, with one infection after another.

It brings up an interesting question: Have we got down to the bottom of these things? In the presence of a number of sources of infection, how can we tell which is important? A young woman, who had a low grade of iritis with deposits on the back of the cornea; had every tooth in her upper jaw pulled out, and was no better. It is up to us to get down to a little better diagnosis, than the mere finding of an eye condition associated with some possible source of infection. The man illustrated a great many sources of infection; and this woman, a perfectly useless sacrifice of teeth, because the X-ray pictures showed, or they thought it did, certain shadows. It may be justified. I am not saying anything against the theory of infection from these foci, but I am pleading for more accurate diagnosis.

Dr. J. T. Carpenter, Philadelphia, Pa.: In these days of intensive laboratory research, it is rather satisfactory to be able to point to the clinical solution of a problem. Five or six years ago, I reported a case before the College of Physicians, exactly similar to those reported by Dr. Hansell. A young woman of twenty years was referred to me on

account of blindness, and there was a moderate neuroretinitis, with a few scattered hemorrhages and swelling of the disc. Vision was reduced to fingers, and the usual search was made for the cause. It was only when Dr. Francis Packard removed the tonsil on the side on which vision was affected that a prompt and immediate return to normal vision occurred. She has since enjoyed absolutely normal vision, and there was prompt subsidence of her ophthalmoscopic signs of neuroretinitis. We can say, in this case, that the focal infection was responsible for the eye condition; because it immediately subsided, and for several weeks every other form of treatment had been used without result.

Dr. William Tarun, Baltimore, Md.: Because the dentist extracts the tooth and finds it free, there is no proof that the abscess is not present. If the X-ray were taken afterwards, very likely the abscess would still be seen on the film. You should insist that the dentist currette the alveolar processes. Otherwise, the sac remains there after the extraction is done. That is a point frequently overlooked. The toxin comes from a localized abscess somewhere, either in the teeth or the tonsils or elsewhere.

Dr. W. G. M. Byers, Montreal, Canada: The one thing that stands out clearly in the work with these focal infections during the past few years is that one has in the system, almost invariably, multiple foci of infection, which must be dealt with; and that it will not do to draw from the history a few preconceived etiologic possibilities, and rest satisfied, certain of their having been affirmatively proved.

To get the best results and to avoid the evil of which Dr. Woods has spoken, we must adopt a strenuous type of examination. Certain things must be gone through with as a routine. The question that we should have in our minds is: What is the minimum that will give us the full information regarding all the etiologic possibilities underlying any given case? Having these, we can come to some definite conclusion as to what is the right thing to do.

Dr. William H. Wilder, Chicago, Ill.: I am glad that Dr. Byers has said what he did. The whole subject is more or less obscure, but there is one element that we must not lose sight of—an element of great importance; and that is the time element in these cases. We are dealing with a possible inflammation of a nerve structure, and time is an important thing. The earlier we make the diagnosis, and the earlier we find the focus of infection, if there is a toxic element, the better for the patient.

We have all seen cases where blindness came on promptly, a considerable time before any sign that can be observed with the ophthalmoscope. This is seen in syphilitic leptomeningitis, in ethmoid, or sphenoid infection, and in infection from other foci. As a routine measure, we should go thru these various investigations as thoroughly and quickly as possible.

In my cases where there is a suspicious origin, I have the prostate stripped, to make sure that there is no latent gonorrheal infection. Whether the lesion in the nerve is a perineuritis, an interstitial infection, or a diffuse infection; whether it is as far back as the chiasm, or affects that portion of the nerve that lies in the orbit, it is not always possible to say; until we have an opportunity to make a pathologic examination. Nor can we tell what the virulence of the infection is. These varying infections have varying degrees of virulence. In some we may expect to find rapid disorganization of this rather small bit of nerve tissue that is so important to the eye. I think ophthalmologists in general, should be urged to make this investigation promptly, and institute whatever method of therapeusis is indicated as promptly as possible.

Dr. Lambert: I should like to add a case almost identical with the second case reported by Dr. Hansell. It was that of a lady with low grade uveitis. The Wassermann was negative. There was a history of rheumatism; but she was in pretty good health except that she had diseased tonsils, which were discovered rather early. These were removed and she made a perfect recovery.

Hereditary Optic Nerve Atrophy.

Dr. William Zentmayer, Philadel-

phia, Pa., reported of two families showing the tendency to this condition, with interesting X-ray findings. In the first family there were three males and one female. One male died in youth of typhoid fever; the other two are affected. The female is unaffected. In both of the patients the X-ray showed the pituitary fossa somewhat enlarged. In the second family there were four males and three females. One male died in infancy; the next two are affected, and the youngest is as yet unaffected. Two sisters are unaffected. The mother was the only child. She is unaffected. The father is unaffected.

In one affected male the pituitary fossa was above the normal in size; in the second it was on the border line. In the one unaffected female (age thirty years) the fossa was of the same size as that of the affected male, having the fossa of border-line size. Dr. Henry K. Pancoast, who made the X-ray studies, thus summarizes the findings: Each of the four patients showed a pituitary fossa which was either at the border-line of normal in size, or was slightly past this point.

Tuberculin in Affections of the Eye.

Dr. John E. Weeks, New York City, read the paper published in full on page 753.

Discussion:—Dr. Samuel D. Risley, Philadelphia, Pa.: I should like to report one instance which seems to answer one of the inquiries in Dr. Weeks' paper. During my vacation, my assistant surgeon and my son admitted to the Wills' hospital a large, muscular, but not fat, Russian, apparently in excellent health; who claimed to have always been well. He had a large proptosis of the right eyeball. It was projected forward, by an inflammatory condition, apparently in the orbit, which was diagnosed as a gumma of the orbit. There seems to have been no Wassermann reaction taken, but he was placed on mercurial inunctions, carried to the point of ptyalism, but without relief.

All treatment was stopped, and his temperature taken four times daily for a week or ten days, with a uniform evening rise of temperature. In the meantime, he had an immense swelling and tenderness of his parotid gland on the same side, and, in a few days, a swelling of the ramus of the right jaw, intensely hard. He had no bad teeth, and no means of accounting for it by focal conditions present.

Observing the steady and daily rise of temperature, I concluded that I could give him a diagnostic dose of old tuberculin. In a few hours, his temperature began to rise, and went up to a 103°. He suffered in all tissues, and had backache, restlessness and soreness following this dose; and a great increase of his suffering from the orbit and the inflammatory conditions. His temperature went down in forty-eight hours, and then he was relieved from pain in the orbit. The parotid swelling began to soften. I waited a week, and then repeated the dose, with almost similar results. When the reaction subsided, he was enthusiastic over the relief he had received.

The proptosis began to reduce, the hard growth in the ramus of the jaw began to disappear rapidly. The proptosis entirely disappeared after the third dose, and the man wanted to go out of the hospital and back to work again, which, when it was safe, he was permitted to do. I reported the case to the College of Physicians at the time. Two months later, he returned to the hospital with a marked syphiloderm all over the body. Then there was a very positive Wassermann reaction. The man was then placed on mercurial treatment. The general lesions disappeared, and he has been well since. He was kept under observation for a year or more.

Dr. A. E. Davis, New York City: Some of these cases take enormous doses with no reaction; while in others the smallest dose is enough to produce a reaction. A young girl, seventeen or eighteen years of age, had a keratitis and iritis, and reacted to the old tuberculin in all three reactions, local, focal and general. We began treatment with the bacillus emulsion, one minum. When she got the fourth dose, there was some reaction. The fifth caused her temperature to rise to 105°, and her pulse, to 100. There was swelling of the tonsils,

the parotid glands were involved; and she reacted all over. They sent to me from the hospital, thinking that she had pneumonia; but after ten days, she came back to normal. Subsequently, we could not go above two minims. The inflammatory process subsided in a few weeks, and she has been well for a year and a half.

I have had one patient under treatment for five years. It was a case of choroidal tuberculosis, in which one eye had been lost. The patient had been treated for syphilis for a number of years before coming under observation. There was an active choroiditis. In the fourth year, he stopped the treatment for two months, and had a recurrence of the trouble. He was put back on the treatment, and is still on it. He gained thirty-five pounds on the treatment. He maintained that weight until he stopped it. Then he began to go down, to lose flesh and to have flashes in the eye. As to the form of tuberculin, I am like Dr. Weeks in preferring old tuberculin.

Dr. Hiram Woods:—Dr. Theobald Smith, in an article upon Vaccine Therapy, answered a number of the questions which Dr. Weeks has brought up; for instance, as to the possibility of harm coming from tuberculin. He emphasized the fact that tuberculous troubles in general medicine have "Hands off" written all over them, so far as tuberculin is concerned, when there is fever or any sign of an active process going on. In localized tuberculosis, to which ocular tuberculosis would belong, so long as there exists evidence of acute inflammatory disturbances, you are more apt to do harm than good by the use of tuberculin. But the place for tuberculin is in what he calls the residual tuberculous infection, cases that hang on and relapse from time to time.

I have reported cases in which I believe that harm was done. One patient was a woman who got too much tuberculin, I know now; altho the dose was smaller than they are giving today. She had an old atrophic process in one eye; and in the other an acute process. I gave one milligram of old tuberculin. There were, within twenty-four hours, the elevation of temperature and pain, and a definite reddening of the area near the point of an old exudate. Her vision was reduced from 20/40 to 20/200, and never got better.

I saw a girl with a choroiditis in the periphery. She had a large area of exudate near the fovea. She had, after the injection of 1:1000 milligram of old tuberculin a fresh return, which did not reach the fovea. That healed up, and she got well.

I have a patient who, for six years, has been taking moderate doses of tuberculin, very small doses; but when the tuberculin is stopped, her flashes begin. She falls off, becomes nervous and fidgety, and is almost like a person without dope who is dependent on it for comfort and welfare. Also, after she has been two months without tuberculin, she will develop those symptoms that we see with a mild choroiditis.

Dr. Byers:—It is my conviction that tuberculin treatment is a two-edged sword, and that it is not likely to be given with benefit by men who have not previously studied the question. It would be better, in the great majority of instances, for men giving tuberculin to associate themselves with practitioners who make a specialty of treating tuberculous cases. I have never seen harm follow a tuberculin reaction. On the contrary, I have always noted that it did good. There are, however, many instances on record where a tuberculin reaction has done harm; and one should proceed, for this reason, very cautiously.

Chiefly as the result of an experience of my confrere and colleague, Dr. Tooke, we now consider that one milligram as an initial dose is too high. A quarter grain dose, in a woman of twenty-six gave a decided local and focal reaction. There were records of eyes distinctly tubercular on microscopic examination that failed to react to tuberculin. If a supposedly tuberculous eye does not react favorably to tuberculin treatment, a reconsideration of the diagnosis is necessary. It is my belief that in tubercular eyes, properly given, tuberculin seldom, if ever, fails to do good.

Dr. Woods has brought up the point of the danger of treating these patients with tuberculin, especially acute cases.

My confreres at Saranac Lake, with whom I have been intimately in touch in all my practice, and my brother, lay very great emphasis on the importance of allowing cases to come into a more or less chronic condition before tuberculin treatment is instituted; taking advantage of the interval to build up the natural combative forces of the body by the usual hygenic measures, such as good feeding, rest, fresh air and the like. My own preference is always for the bacillary emulsion; and we lay a great deal of stress on having it freshly prepared and, of course, on methods of sterilization.

Dr. Edward Jackson, Denver, Colo.:—I have a distinct preference for the old tuberculin for therapeutic, as well as diagnostic uses. Another point that I believe is extremely important, and not generally appreciated is that enough time should elapse between doses. Not only should tuberculin not be used in relatively acute cases, the changes that are produced by one dose of tuberculin should pass from the acute to the chronic condition before the dose is repeated. My rule is not to give the dose oftener than once in two weeks, to start with; and not more than once in one week in any case. Some cases have done better with three or four weeks between the doses, than with the two weeks' interval.

With reference to the time of treatment, I think that these cases must be watched, and often treated from time to time, as long as they have tuberculosis; and with some, that will be as long as they live. I have now a patient that has been treated for seven years, taking tuberculin doses for a considerable part of that time. Within the last year, she has had a recurrence of kerato-iritis. Another case has now been treated for five years. The patient came to Colorado fifteen months ago with a recurrence. I want to emphasize the importance of a point that Dr. Byers alluded to, the general treatment of the case along the usual lines of treatment for tuberculosis. It is impossible to get good results without attending to that.

Tuberculin can produce permanent harm. In one case of intraocular hemorrhage in connection with disease of the retinal vessels, I saw, on two separate occasions, fresh hemorrhages following within forty-eight hours of the dose of tuberculin. In other cases, I am sure that there has been some aggravation of the symptoms after what were, for them, excessive doses; although comparatively small doses as ordinarily estimated.

Dr. S. Lewis Ziegler, Philadelphia, Pa.:—Some twelve years ago, I presented a case before the Society, of tuberculosis of the cornea, which I had treated by repeated doses of old tuberculin. I fully agree with the view that the old tuberculin is the best tuberculin to use. As to the length of time and the dosage, I think that small dosage is certainly of the greatest advantage. The interval, as a rule, has been one week. The lesions that I have seen, in upwards of fifty cases, have been mostly in the cornea and sclera; and I remember one very marked case of choroidal disease that passed on to cataract.

In most of the cases, there was a marked early reaction. That reaction was soon dissipated, and the cases passed on, after that, without reaction. But the injections were continued for a long time, so as to be positive that the lesion had been eradicated. In regard to the co-operation with the general practitioner treating tuberculosis, it is somewhat difficult for the specialist to co-operate, for the reason that the majority of internists are very skeptical with regard to the use of tuberculin for this purpose. They are almost antagonistic to its use.

Dr. F. H. Verhoeff, Boston, Mass.:—Eleven years ago, I was a strong advocate of tuberculin treatment for chronic ocular tuberculosis; but I have changed my views entirely since then. My earlier conclusion was based on the lack of clinical experience. I thought that when we had a case of chronic ocular tuberculosis, it would do badly if left alone. But the fact is that the majority of cases do well, and it is only the exceptional case that does badly. I treated cases with tuberculin and they did well, and I thought that it was a remarkable remedy.

But since then, I have had more experience, and find that in the very bad cases, in which you want tuberculin to

do good, it utterly fails. In the cases that are getting worse, it perhaps makes them worse. I abandoned the use of tuberculin, and found that the cases did well under simple hygenic measures. The most important thing is rest.

I think that tuberculin, for diagnostic purposes, is seldom necessary, now that we know the clinical picture of tuberculosis. It is unnecessary in the vast majority of cases. Occasionally you get a case in which you are not sure of the diagnosis, and you can then use it. I suppose that damage is done occasionally. I have not seen bad results. I have seen metastases occur in the cornea and, in one instance, a small distance from it, evidently due to the tuberculin reaction; and I should suppose that it could occur in the fundus also, where it would do more harm. I do not say that tuberculin may not hasten some of these very sluggish cases of tuberculosis, by getting a reaction and subsiding just a little more quickly; but it is splitting hairs to determine that point. Personally, I have become convinced that there is no use in running any risk by using tuberculin; so I have entirely abandoned it.

Dr. Weeks, closing:—The majority of cases in which I find the use of tuberculin necessary are progressive cases. The theory, of course, in regard to the bad effects of tuberculin in acute general tuberculosis, is that the system is so dominated by the toxins of tuberculosis that it has not the power to produce antibodies to combat these toxins; and that the system must be allowed to recover that ability, if it will, to make tuberculin of any value.

When we have tuberculosis of the eye, we have, as a rule, a localized tuberculosis process. Under such conditions, the system is not so saturated with toxins that antibodies cannot be formed; and the accepted theory is that the antibodies are formed and these toxins are combated. So I can hardly see any reason for saying that a tuberculous process must be inactive, in order that it may be influenced by tuberculin.

The last speaker has stated that the use of tuberculin does not seem to be of great value. I have had three cases referred to me for enucleation, advised by the people who sent them to me; and the patients have at present very good eyes, because the careful use of tuberculin was persisted in. The remark that it was splitting hairs to differentiate between the cases puts me in mind of a remark of one of my old teachers, that I must not split hairs in determining refraction. But it was just that hair-splitting that was of value to me in establishing me in the practice of ophthalmology. I think that the splitting of hairs in a thing of this kind is what we all should do.

(*To be continued*)

ABSTRACTS

Hine, M. L.—Recovery of Fields of Vision in Concussion Injuries of the Occipital Cortex.—Brit. Jour. Ophth., v. 2, p. 12.

For many reasons it is not often possible to make daily examinations of the visual fields of patients with recent occipital injuries during the period of recovery. Hence the writer considers it will be of general interest to record the results of such examinations obtained during the past few months in a large base hospital camp in France, where he was able to watch during the recovery period at least five patients, amongst many others with head injuries, who had occipital lesions which could be classified under the heading of "concussion injuries." Three of these had fracture of the skull and were seen at operation to have either subdural or extradural blood clot with the dura itself intact; the other two had scalp wounds in the occipital region, but no demonstrable fracture.

Hine gives the histories of these patients with diagrams, showing the location of the external injury, and of the fields of vision. Tho the cases are few in number, they suggested certain conclusions, some of which had been reached recently by Lister and Holmes. These are:

1. In the case of an injury at or near the occipital pole the hemianopia is very frequently complete, there being much less frequently macular escape than in the majority of cases with lesions (chiefly vascular) producing hemianopia, met with in civil practice. This is explained in the paper by Lister and Holmes as being due to the situation of the macular area in the cortex at the posterior end of the calcarine fissure, by the occipital pole, each half of the macula being represented on one side only, the right half of each macula in the right cortex and the left half in the left. The more usual escape in civil practice is attributed to an overlapping of the arterial supply by the posterior and middle cerebral vessels.

2. The visual fields are gradually restored by recovery from center to periphery. It may be noted that a scotoma caused by loss of cerebral substance gradually contracts from periphery to center as the surrounding edema of the brain subsides.

3. The field of vision usually returns in the upper quadrant before the lower, and, in the writer's experience, never vice versa, this being due to the fact that all the injuries recorded here have been above the occipital pole, which is situated as a rule about one inch above the inion. Hence, the occipital cortex above the calcarine fissure, which represents the lower part of the field of vision, has borne the brunt of the blow. Any injury below the occipital protuberance is much more likely to be fatal, owing to injury to the cerebellum and medulla.

4. The restoration of function at first is incomplete, but when once it has commenced it seems to proceed in a definite order—color perception coming after the perception of white, even tho the colored object is the larger, and, as recovery takes place the appreciation of colors becomes more and more acute, so that small colored objects can be distinguished further and further away. By this means, in suitable cases, one can roughly measure, for clinical purposes, the recovery of function in the macular region.

5. Hence it is necessary when suspecting occipital cortical injury, to use small colored test objects as well as white, or else a partially recovered lesion may be missed, or lesser injuries to the cerebral cortex of the occipital lobe may be overlooked.

6. On the other hand, in the more slowly and steadily recovering cases with subdural or extradural hemorrhage, there would seem to be no such separation between color appreciation and appreciation of a white test object. This could be explained by supposing a less severe injury to the macular area, while only a careful comparison of the color fields from day to day could show whether they increased proportionately to the fields for white. Such examination would, however, in most cases be impossible or unreliable on account of the patient's condition.

C. H. M.

Tillot. — Traumatic Ulceration of Cornea, with iritis, treated with dionin. — La Clinique Ophtalmogique, v. 22, p. 451.

This is a report of the personal observations of the author upon himself. Some powdered tin chlorat accidentally fell into Tillot's eye. The pain was intense; and despite immediate flushing, cocain and hot applications, the chemosis became most severe. Finally the cornea was denuded, superficial vascularization occurred, with loss of substance, iritis with synechia. Vision was reduced to inability to count his own fingers. This continued despite treatment, and on the twenty-fourth day the instillation of ¼ per cent dionin was begun, twelve times daily. Immediate improvement resulted; and six weeks later, the vision had returned and only a faint vascularization could be seen with oblique illumination.

J. S. W.

Fuchs, E.—Anatomy of Some Congenital Anomalies of Retina and Optic Nerve.—Graefe's Arch. f. Ophthalmol., v. 93, p. 1.

ANOMALIES OF THE RETINA.

Fuchs refers to the anomalies, which Seefelder and Lindenfeld discovered in the pars optica and pars ciliaris of the retina in fetal eyes.

Fuchs studied not fetal eyes, but eyes more developed, one of a child of 7, one of 8, one of 14 years, and 4 of adults. The 4 first mentioned had been enucleated on account of recent injuries; the others were taken from the corpse. Fuchs reports of pars optica:

1. Rosettes were not found in any of the specimens.

2. Folds of the retina were met with in case 1 and 3. These when found were incomplete, consisting partly in foldlike processes of the retina with atypical structure, partly thru a forward inthrust of the external layers. Fuchs found three of the first, and two of the second character.

3. Of cysts only one instance was met with in Case 1. It was situated in the temporal half, in the equatorial region. Its structure was more complicated than the one described by Seefelder. The inner space of the cyst was slightly oval; the surrounding layers of the retina were somewhat thinned. The inner wall of the cyst was formed by cells that resemble the cells of the outer nuclear layer. Within the cavity of the cyst there are a number of large very pale cells that resemble epithelial cells where they are packed closely. They are filled by small, irregular, slightly luminous corpuscles. Whether they are due to fatty degeneration or whether they are cells of the pigment epithelium, whose pigment has faded, is an open question.

4. Irregular growth and hypertrophy of the pars optica was met with in a number of the cases. In one instance the ora serrata reached farther forward than in normal eyes, the distance from the iris angle being 4 mm. temporally and 3.3 mm. nasally against 5.6 and 4.6 mm. in normal eyes.

5. An anomaly not mentioned by the previous authors, is a thinned portion of the retina. Fuchs found two instances of this condition. The thinned retina is reduced to one-sixth of its normal thickness. These areas were located in the equatorial region, in different meridians.

PARS CILIARIS.—1. Hypertrophy of the cylinder cells was seen in quite a number of the cases. The findings resembled very closely those found in fetal eyes.

2. Just as frequently areas were encountered, where the ciliary epithelium contained more than one row of cells; in some instances four or five rows of nuclei were present.

3. Fuchs discovered the presence of "islands of atypical retina within the pars ciliaris." In 3 cases, instances of this anomaly were found. They were quite numerous in each of the specimens. Fuchs gives the following description: Within a small space the row of epithelial cells is replaced by a piece of atypical retina, which consists of a network of glia, filled irregularly by nuclei. This piece of retina is considerably thicker, than the ciliary epithelium. It is also larger in area; and, in order to find room within the smaller space of the epithelium, it is folded. It appears, therefore, like a fungus with a strangulated base.

CONUS FROM THE PAPILLA DOWNWARD.

In 1913 Tertsch collected seven cases, one his own, where a downward conus had been found ophthalmoscopically and where afterwards an anatomic examination could be made. Fuchs adds to these, three cases; and gives a minute description of the findings.

In the first case the ophthalmoscope revealed a white conus downward and slightly inward, about half as wide as the papilla. The latter itself was oval and was rounded by the conus. Distribution of the blood vessels is somewhat irregular, and the excavation of small degree. The eye is of normal size and shows a slight bulging of the sclera in the lower half. The optic nerve enters the eyeball obliquely from

below upward. Within the scleral canal it makes a sharp bend in the opposite direction, so that its axis forms an angle that opens downward. The sclera is of normal thickness. The nerve fibres are also normal. Below the optic nerve the sclera is bulging. The anterior portion of the lower wall of the scleral canal, down to the place where the choroid commences, must appear ophthalmoscopically as a white conus.

In the second case the width of the conus was one-third that of the papilla. There was also a bulging of the sclera below the entrance of the optic nerve. As the latter had been severed very close to the eyeball, nothing can be stated on the direction of its insertion. Above the edge the scleral canal and the choroid project; below they are flattened.

In case 3 the conus was the smallest. The eye was of normal size and the sclera did not bulge. The optic nerve entered the sclera perpendicularly. Above its entrance the scleral canal and the choroid project as in the second case, but to a less degree; below they are bent and flattened.

The changes found by Fuchs are similar to those found by previous authors. The width of the conus is proportional to the degree of the changes around the optic nerve. If the latter are small, the form of the eyeball is normal; if larger, the sclera bulges below the papilla. This ectatic area of the sclera is thinned and in some instances also the choroid and the retina are found thinned. The pathologic findings in cases of conus downward are identical with those in temporal conus. Both are the result of the ectasia of the sclera. The term coloboma is therefore inappropriate. But the important difference between temporal conus and conus downward lies in the fact that the former commences during life and is frequently progressive, whilst the latter is congenital and stationary. It is also frequently complicated by other congenital anomalies, and in nearly all the cases astigmatism and impairment of vision are present.

EXCRESCENCES OF RUDIMENTARY RETINA AT THE EDGE OF THE PAPILLA.

These excresences are irregular lobules, which consist of mesodermal glia, nerve fibers and elements of the retina. They grow from the optic nerve within the scleral ring or immediately after its exit. Of elements of the retina those of the nuclear layer are most frequently found, embedded in a network of glia. Fuchs divides the cases into two categories: Excrescences that grow on the inner plane of the sclera under the choroid and excresences that grow backward into the optic nerve, into the subdural space or into the sclera. Of the first category there are 11 cases on record, 7 of the author's: Of the latter 9 cases (1 of the author's). With one exception the direction of the excrescences under the choroid was a downward one. They are generally pedunculated while the excrescences backward occur in the form of a finger.

STRAY OPTIC NERVE FIBERS.

Fuchs distinguishes two kinds of stray fibers of the optic nerve: 1. Isolated bundles of the uncrossed portion of the nerve, and secondary nerve fibers that leave the nerve and lose themselves in the surrounding connective tissue.

Four cases of the first kind have been described previously. In one there was found a bundle of nerve fibers, which originated in the corpus geniculatum, ran forward along the optic tract and the chiasm and finally joined the optic nerve at its temporal side. In another, the anomalous bundle also started from the corpus geniculatum and finally entered the optic nerve on its temporal side. In a third it separated from the nerve immediately behind the eyeball. In the fourth the bundle left the main trunk somewhat farther behind the ball and joined the chiasm. The case reported by Fuchs belongs probably to this category.

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WIDER USE OF THE TONOMETER.

Readers will find in our last issue the abstract of an interesting paper by Dr. Morax, of Paris, relative to some atypical initial signs of subacute glaucoma. This paper is timely and demonstrates how even an acute observer could have been misled, and make a faulty diagnosis of a "neuropathic condition," when in reality a beginning glaucoma was at the root of the trouble. The use of Schiötz tonometer changed absolutely the trend of events, and permitted a correct diagnosis to be established and a proper therapy instituted.

The two uncommon initial symptoms which Dr. Morax describes, orbitofacial pain and lacrimation without lesion of the lacrimal passages, altho certainly worthy of careful consideration, would have been of little value by themselves in establishing the diagnosis, but for the tonometric examination which made evident the condition of the intraocular pressure.

Dr. Morax has rendered a good service to the profession in calling attention to the necessity of a widespread use of the tonometer, when obscure symptoms may be traced to an increase in the ocular tension, but we may go further and state that after the age of 40 years, in every patient subjected to a thoro eye examination, the intraocular tension must be taken as much as a routine examination as the blood pressure is nowadays ascertained.

A wider use of the tonometer is a real necessity and will make clear the diagnosis in many obscure cases. It is to be hoped that such a good instrument will find its way into a more general use.

Perhaps some ophthalmologists may question if the high readings of the tonometer in the absence of any other of the common symptoms means glaucoma, and if Morax is justified in performing an iridectomy when vision is normal, pupils normal, visual fields intact and no excavation is present in the disc.

The writer as far back as 1901 tried to emphasize the importance of a clear distinction between hypertension and glaucoma. Hypertension is a common symptom for both primary and secondary glaucoma; but it is only indicative of the former when no other disease, inflammatory or mechanical, exists in the eye. If there is no history of eye trouble and if we do not find on careful examination any disease, secondary glaucoma can be fairly discarded. Still, it is necessary to have in mind and to search closely for deposits on Descemet's membrane. There are some border line cases between serous iridocyclitis and glaucoma in which only repeated and careful examinations of the iris and cornea can settle the diagnosis.

We may safely assume that if no secondary glaucoma, inflammatory or mechanical, exists, and if the examination with the tonometer shows an increase to more than 30 mm., we are dealing with a case of initial primary glaucoma.

In former times we relied on the subjective symptoms of transient blurring of vision, colored halos, slight dilatation of the pupil, and on the objective signs of shallowness of the anterior chamber and hardness of the eyeball on palpation, to make the diagnosis of prodromic glaucoma. But prodromic symptoms mean an impending or actually commenced attack, altho only of a mild type. If these early symptoms did not exist we were entirely at a loss to make a diagnosis of glaucoma. Even the palpation with the fingers was deficient and sometimes misleading.

In simple chronic glaucoma the cupping of the disc and the nasal contraction of the visual fields were our better diagnostic signs. Now, happily, we have in our possession a good instrument with which our diagnosis of hypertension is readily made and its degree accurately measured. The perfection and usefulness of the Schiötz tonometer is made clearer when the tension is taken periodically and we are able to detect the changes produced by treatment.

In Morax' cases the use of miotics relieved not only the increase of tension but also the orbital and facial pains and the lacrimation, showing these symptoms were due to a glaucomatous condition.

The writer has now under treatment a patient, a one-eyed lady, 74 years of age, who complained only of failing vision. Examination of the fundus showed some changes of the refraction in the cortex of the lens, which were not considered sufficient cause for the failing vision. Papilla was not excavated; tension to fingers doubtfully increased. The tonometer showed a tension of 39 mm. Miotics increased vision from 1/2 to normal, but the tension only subsided to 21 mm. after some weeks.

I certainly consider iridectomy perfectly justified in cases in which even in the absence of the classical symptoms, the tension does not decrease to normal with the use of miotics, or if relapses of high tension occur. At this stage of the disease there is probably no adhesion of the root of the iris to the cornea, an increase in the albuminoid contents of the aqueous and vitreous, which makes filtration difficult and produces an edematous condition of the vitreous by the accumulation of colloid products being only responsible for the high tension.

It is to be regretted that we have not yet an instrument at our command which enables us to observe if the root of the iris is free, if the normal angle of the anterior chamber is preserved, or if a new angle has been framed by adhesion of the root of the iris to the cornea. In the former case we may have the chance to wait and use miotics and general treatment; in the later iridectomy will be absolutely necessary to prevent the adhesion becoming permanent and entailing a complete loss of the eye.

Not only in cases of primary glaucoma are tonometric examinations of great value as a routine practice; but in many other diseases accompanied by hypertension its use is highly serviceable from the point of view of treatment. Marbaix (Ann. d'Oculist, 155, p.

27), has lately insisted on the importance of systematic examination of the tension in cases of interstitial keratitis, scleritis, anterior choroiditis with vitreous opacities, iritis, high myopia and retinal hemorrhages. In a case of interstitial keratitis in which a prolonged use of atropin seemed beneficial, a dilatation of the pupil having been obtained, Marbaix found T. = 70 mm. The patient complained of cephalalgia, which entirely subsided with the discontinuance of the mydriatic.

In a case of diabetic iritis a tension of 50 to 70 mm. was not attended with any pain; still the vision had lowered to 1/3 to 1/10. General treatment and miotics made the tension decrease to 30 to 40 mm. The author waited only for a diminution in the quantity of sugar to perform an iridectomy.

The "atropin cure" frequently prescribed in young myopes may be dangerous, he asserts, if the tension is not examined beforehand. In a case of high myopia, tension had raised to 70 mm. and severe headaches were present. An increase of myopia can be produced by such augmented intraocular pressure.

M. URIBE-TRONCOSO.

OCULAR LESIONS OF INFLUENZA.

These are extremely varied in character; and they occur largely as sequels, so that the interest of the ophthalmologist in the present epidemic is rather prospective. Those whose practice includes ear, nose and throat work, will meet relatively few of the eye lesions during the height of the epidemic. Later it will be demonstrated that many widely different conditions are traceable to this cause. The proportion of patients suffering from influenza, who have eye lesions, is really small. But so large is the number of persons affected in one of these epidemics, that the aggregate of the ocular lesions is quite important.

The influenza bacillus of Pfeiffer closely resembles the Koch-Weeks bacillus. Some observers have suggested that they might be identical. But the wide difference in the clinical manifestations of their pathogenic powers, negatives any such supposition. Either may produce a conjunctivitis, but there the resemblance ends. The clinical picture of acute contagious conjunctivitis is characteristic and fairly constant. That of influenza conjunctivitis differs from the former, even in its nearest approaches, and varies in its clinical features; and the other ocular lesions of influenza are practically unknown in connection with acute contagious conjunctivitis.

The influenza bacillus forms a toxin that shows a powerful affinity for the whole nervous system. In this respect it most nearly resembles the diphtheria bacillus. In connection with the eye, the effect of such toxin is manifest in spasm or paralysis of the accommodation, pareses or paralysis of the extraocular muscles, photophobia, transient amblyopia, optic neuritis, optic atrophy, neuralgic pain apparently not caused by local lesions; and persistent asthenopia, from which the patient may recover after several months or even years.

Altho few young children may suffer from influenza, the conjunctivitis caused by the influenza bacillus occurs mostly in children under one year old, and sometimes in the newborn. In the latter it may closely resemble a gonococcus infection; or it may be pseudomembranous in character. Even in such cases it is not usually attended with serious general symptoms; and the mass of cases are mild without notable corneal involvement.

Often the first symptom is swelling of the upper lid. But this may occur in cases of influenza in which no conjunctivitis arises. Spriggs (Ophthalmoscope, 1909, p. 505) reported an epidemic in which the cases began with swelling of the lids and conjunctiva, but without discharge. In 24 hours this was followed by headache; and in half the cases this constituted the whole of the attack. In others the symptoms of influenza ran the usual course.

It would be reckless to state of any form of ocular inflammation that it

does not occur as an effect of the influenza bacillus; but it is certainly very unusual to see corneal ulcer or sloughing as an extension of conjunctival inflammation. The more common corneal lesions are herpetic or dendritic ulcers, of neuropathic origin. A deeper corneal inflammation may be associated with uveitis. These conditions commonly arise after the general symptoms of influenza have run their course. But they may yield promptly to a specific vaccine.

Uveal inflammations associated with influenza show great variety. The most violent panophthalmitis with terrific pain, going on to the rupture of the eyeball in a few days, has been seen. On the other hand there may be a low-grade chronic inflammation, without any acute symptoms, that proceeds ultimately to shrinking of the eyeball. The ocular disease may be metastatic in origin; but has arisen from infection of operative wounds of the eyeball. An eye previously blind and degenerated may take on acute inflammation thru influenzal infection. The vitreous seems to offer an especially favorable culture medium for the influenza bacillus, so that in the cases of panophthalmitis it is apt to give an abundant culture of the organism.

The tendency of influenza to leave chronic infection of the nasal accessory sinuses, and focal infections elsewhere, is responsible for some of the uveal infections. But it is still more likely to cause trouble in the orbit. Orbital inflammation from influenza, either cellulitis or abscess, may be one of the primary manifestations of the disease; altho it often begins to attract attention only when the general symptoms are on the decline. It may also arise from inflammation starting in the eyeball, and has followed infection of an operative wound of the eyeball or orbit. But probably the greatest number of these cases have arisen after general recovery from the influenza, in connection with the sinus disease that has remained as a sequel of influenza. It is liable to involve any structure in the orbit. The eyeball, the ciliary ganglion, the muscles and the optic nerve have all been damaged in such orbital disease. Prompt treatment is indicated, including free drainage of the orbital abscess and of the affected sinuses.

The optic nerve is perhaps more likely to suffer from influenza than any other part of the visual apparatus. A condition simulating toxic amblyopia has been reported, as attending the influenzal attack; and retrobulbar neuritis, with some visible alteration of the nerve head has been recognized in other cases. These conditions may affect one or both nerves, and may end in partial or complete recovery. In a smaller proportion of cases, the result is severe or complete optic atrophy. This latter termination is more likely to occur in cases caused by sinus disease and may become an indication for opening the sinuses, even in the absence of positive, local or X-ray evidence of the sinus disease.

In the retina, Knapp (Arch. of Oph., v. 45, p. 247) saw a star shaped figure, such as is connected with albuminuric retinitis, associated with an optic neuritis, and disappearing with recovery from the latter condition. Thomas and Coats reported (Trans. Ophthalmol. Soc. of United Kingdom, v. 31, p. 149) a case of granuloma forming in the retina near the optic disc, and followed by detachment of the retina. The eye became blind and painful and was enucleated. Glaucoma, in which the first inflammatory attack accompanied or followed shortly after influenza, is not very rare. Cases of senile cataract are apt to show marked increase of the lens opacity with or shortly after an attack of influenza. In some of these cases some clearing occurs subsequently; in others the progress seems accelerated from that time.

From a review of previous experiences with influenza, it seems sure that some ophthalmologists will be consulted during the height of the epidemic with regard to certain complications arising during the influenzal attack, especially acute conjunctivitis, swelling of the lids, metastatic ophthalmitis, orbital cellulitis, and optic neuritis. But after the epidemic has

largely passed, there will come under observation a greater number of cases, in which the ocular condition must be regarded as a sequel to the influenza. During the prevalence of the disease the danger of infection of operative wounds should be borne in mind, and operations should be deferred, if this is possible without serious disadvantage to the patient. E. J.

ARTIFICIAL EYES VS. PATRIOTISM.

A short time ago a number of ophthalmologists in this country received letters from a manufacturer of artificial eyes; requesting that they use their influence at Washington to induce the Government to allow this manufacturer certain special importation privileges with Germany, to enable him to manufacture the same quality of eyes he had previously been in the habit of making.

The manufacturer in question received several communications from ophthalmologists of this country indignantly protesting against such a petition. He probably appreciates by this time, that the loyal physicians of this country are in no mood to have anything to do with the Central Germanic Powers, except to defeat them unconditionally; and then to endeavor to assist them in becoming decent citizens of a decent world.

The Germans are undoubtedly an intellectual and scientific race of people. They have devised many things from which they have acquired a practically exclusive trade. Medical men have depended upon Germany for certain drugs, dyes, appliances, etc. Inasmuch as such articles could be purchased from Germany and were of superior quality and cheap, Americans have purchased them and have used them with satisfaction. But there is really no reason why all these things cannot be produced at home, and as a matter of fact they *will* be produced at home, and all we need to do is to realize that they *must* be manufactured in this country; and before long this object will be attained. It is up to us, therefore, to learn to be independent and to make what we need here in the United States and then to protect our own industries. Let all chemical and other manufacturers, therefore, realize that they are facing this problem and must conquer it. Until this condition of affairs is reached, however, let us cheerfully go *without* those articles we have previously imported from Germany, but which we have not yet learned how to produce.

It is not profitable at this time to indulge in expressions concerning the Central Powers of Europe. Paper is too expensive, and we must learn to conserve our nervous and mental energies. It is desirable, however, to urge ophthalmologists to emphatically decline the subtle and dangerous invitation of the before mentioned manufacturer of artificial eyes, to plead for special privileges of German importations; and to patriotically abstain in the future from depending upon new German made goods, until such time as Germany has become a decent neighbor with whom to live, and do business, and it is an easy guess that this will not be for many, many years.

F. A.

BOOK NOTICES

HYGIENE OF THE EYE. By **William Campbell Posey,** A. B., M. D., Professor of Diseases of the Eye in the Philadelphia Polyclinic. 8vo., 354 pages, 120 illustrations. Philadelphia and London. J. B. Lippincott Co. Price $4.00 net.

The ophthalmologist will feel the greatest interest in this work on account of the four chapters that have been contributed to it by scientific specialists who are not ophthalmologists. The first of these, Chapter VII on "Artificial Lighting," is written by the illu-

minating engineer, Herbert E. Ives, Ph. D., whose original contributions on the subject are among the most important that have appeared in the literature of the last two decades. It is hard to conceive of a more satisfactory, concise, clear presenation of this subject. than has here been made in these 16 pages.

The next chapter of 10 pages on "Daylight Illumination of Rooms and Buildings from an Architectural Standpoint," by William Copeland Furber, architect and consulting engineer, is far less satisfactory largely because it deals with a subject that is yet to be developed, which has received but little careful consideration as compared with the subject of artificial lighting.

The third of these chapters is chapter XIX. "The Blind. Blindness from an Economic and Social Point of View. The Education and Employment of the Blind." It is by O. H. Burritt, M. A., Principal of the Pennsylvania Institution for the Instruction of the Blind, Philadelphia, Pa., and deals with a subject with which every one in active ophthalmic practice should be familiar. It is a subject that is developing very rapidly just now; and this resumé in 44 pages, of what has been done, furnishes an excellent basis from which the wide awake ophthalmologist can begin his acquaintance with problems that are being rapidly developed and solved at the present time.

To every one of us comes the necessity of explaining to the patient and his friends that useful vision for the ordinary affairs of life is for him a thing of the past. In presenting such a situation we should be ready to present with it the possibilities which reeducation and readjustment to new conditions now offer to the blind. This chapter, including the history and statement of what has been achieved for the blind, can be read with profit by every reader of this journal.

The last of these chapters, 5 pages, on "The Popular Movement for Conservation of Vision," is by Edward M. Van Cleve, Managing Director of the National Committee for the Prevention of Blindness, and briefly reviews this movement.

Turning to the chapters written by Dr. Posey, the one dealing with "Wounds and Injuries" will be of greatest interest to the ophthalmic surgeon. In its 40 pages, the subject is approached from the side of causation and prevention; in a way that supplements the discussion of the subject in most text books on ophthalmology. In this chapter the pictures showing the X-ray localization of a foreign body, and its extraction with the giant magnet, seem to have very little connection with the text, and to be rather out of place. Even the "General Practitioner," to whom the book appears to be especially addressed, can hardly be expected to learn much from the pictures with description; and for the laymen, who are also expected to read this work, it seems like an approach to cheap sensationalism.

Some such criticism might also be offered with regard to the introduction of the account of the ophthalmoscope, its history and use, in Chapter II; with a colored plate purporting to show two normal and four pathologic conditions of the ocular fundus. But in justice to the author it must be borne in mind that there has always been a disposition to introduce just such material of doubtful appropriateness into popular works on hygiene. We know of none that is free from this kind of "padding." Something, too, might be said of meeting the curiosity of laymen in regard to such matters. The tendency of knowledge to diffuse itself is as general as the tendency to physical diffusion of gases. It rests on the universal curiosity of the human mind; and the equally general disposition of humanity to tell what one knows. This may account, too, for the special chapters on Cataract and Glaucoma.

Among the other excellent chapters of this book, the one on "School Life and Care of the Eyes," 28 pages, is especially worth reading. The general practitioner may profit, too, by the one on "The Participation of the Eye in Diseases of the General System," 28

pages; and the one on the "Effect of Certain Beverages and Drugs."

The book is well illustrated thruout, and most of the illustrations are not open to the criticism offered above. They help to render clear the thought, and generally in less space than would be required to give as good an explanation in printed words. On the whole it is a valuable contribution to a literature that should exert a greater influence on the thoughtful, and should be more widely read. E. J.

TRANSACTIONS OF THE SECTION ON OPHTHALMOLOGY OF THE AMERICAN MEDICAL ASSOCIATION. Annual Session, June 10 to 14, 1918. 8vo. 317 pages. Illustrated. Chicago A. M. A. Press. Price $1.00, by subscription.

In former years all the papers read before the section on ophthalmology were published in the Journal of the American Medical Association, so that every Fellow of the Association received a copy. This is no longer the case. In the present volume appear papers that have not been published in the Journal, including some of greatest interest and value to the ophthalmologist. This, of course, increases greatly the value and importance of this volume. It was worth its price before, simply because of the convenience of having these papers collected, bound, and indexed for ready reference. Now some of the papers and discussions can only be obtained thru this publication.

Even the presessional volume, sent to members of the section, has but a fraction of the value of this volume. It does not contain some of the addresses and reports made to the Section; and it contains none of the discussions excited by the papers, often more valuable than the papers themselves. The paper represents the experience and views of one member, often obscured by overelaboration, and the introduction of matter of secondary importance to make the paper "complete." The discussion may give the experience and conclusions of a half-dozen equally competent men, compressed and freed from extraneous matter, by the requirements of the five minute rule under which the discussion is carried on; and the restriction to five hundred words in the revised stenographic report.

As with all other publications issued by the American Medical Association Press, this volume is carefully arranged and proof read, neatly printed on good paper and substantially bound. The illustrations, too, are clearly reproduced, and mostly they add substantially to the value of the papers in connection with which they appear. What we have said of this series of volumes before is now more than ever true; it is a series that no American specializing in ophthalmic practice can afford to do without. E. J.

CORRESPONDENCE.

FILARIAL TUMORS.

To the Editor:

I read with great interest under "Editorials" in the August issue of THE AMERICAN JOURNAL OF OPHTHALMOLOGY, some suggestions upon "Ocular Lesions from Filaria and Allied Parasites." The importance that you assign this line of investigation pleases me very much. I am also of the opinion that the parasites must be exactly determined by an expert zoologist. Some weeks ago I forwarded specimen tumors to Prof. Henry B. Ward and look for his answer in the near future.

Meanwhile, the object of these lines is to fortify the opinion that the parasite that causes the changes described in my paper, "Disturbances of Vision in Patients Harboring Certain Filarial Tumors," (AMERICAN JOURNAL OF OPHTHALMOLOGY, February, 1918, p. 122), is not by any means the *Filaria bancrofti*, nor is it a near species; but certainly belongs to the genus *Onchocerca*, and probably to the species *Onchocerca volvulus*, Leuckart, 1893, or to a nearly related one. This would not be strange because of the fact that negroes from Africa worked once in the lands now infested.

These views are based on the studies of my distinguished cooperator Tâcito Molina Izquierdo, to whom I am indebted for the report that I add to this letter.

For my part I have to say: that I have continued my clinical investigations. Since I published my paper, I have examined one hundred more cases; and of this further study, I have nothing more to add to the description, and I hold today it is perfectly certain that patients that have tumors in any part of the body, constantly have ocular disturbances; and patients that have ocular pictures of the disease, have tumors. The lesions are lasting, do not decrease, seem to be progressive and chronic, but the visual acuteness increases considerably and rapidly when the tumors are dissected out. I presume that all the changes are due to the secretions of the parasites in the human organism of a toxic substance that produces changes in the eye and in vision.

Faithfully yours,

R. Pacheco Luna.

Guatemala City, Central America.

OPERATIONS FOR SQUINT.

To the Editor:

Dr. Loeb's paper on Convergent Squint in the September number of the Journal states the case so unfairly to the advocates of real operative cure, and supports his own contention so poorly that I cannot resist the temptation to criticise.

His first argument is that operative work is not invariably successful. How many operations would be done in any surgical field if it were necessary to guarantee 100 per cent results? However, I contend that, *for practical purposes,* an invariable cure does result if the proper operative procedures are employed.

His second argument that a divergent squint develops in some cases is simply an admission that poor work was done in those cases and is another argument against tenotomies of the interni.

His statistics are extremely weak proof of his contention for only 11 out of his 27 were "straight." He fails to state whether this was simply a naked eye appearance or by any of the balance tests. The chances are he means the former, in which event even these 11 are worthless for purposes of statistics. As regards his "near straight" cases there is nothing to be said for, as far as a *useful pair of eyes is concerned* a "miss is as good as a mile." If the advocates of correct operative work could not show far better statistics than his they would very carefully "keep on saying nothing." For, as a matter of fact, few of us who operate do so until we have eliminated the cases that are cured by glasses and visual training. Therefore we begin where he leaves off.

He seems to look at the subject solely from the standpoint of securing a cosmetic result, whereas in many cases, properly handled, it is possible to secure binocular vision of the second degree and occasionally even stereoscopic vision.

None of the socalled muscle cranks perform complete tenotomies of the interni and therefore, in their hands, the chance of having a later divergence is practically zero. Tenotomy seems to fill his mind as being the only available operative procedure.

I doubt very much if Dr. Valk ever intended to convey the idea that he would operate a case until trying, *for a reasonable time,* the usual nonoperative treatment.

When cases are seen in the third or fourth year and lenses assisted by visual training, alternating monocular and binocular with the amblyoscope, fail to give the desired result it is my desire, and practice when permitted, to begin operative work in the fifth year; and I have had no occasion to regret such practice. This is done in order to *increase the chances of securing a functionating pair of eyes* rather than simply a cosmetic result.

It is work such as Dr. Loeb advocates (postponement of cure till too late to train binocular vision) that is the basis of the text book statements to the effect that results are rarely more than cosmetic in the operative cure of convergent squint.

Very respectfully,

Roderic O'Connor.

Oakland, Cal.

To the Editor:

It is not my desire to enter into a controversy with Dr. O'Connor, but his letter in this issue of the JOURNAL requires a reply. My article nowhere states that operation for squint is unnecessary. I, too, have operated on such cases and have had my share of good results. The purpose of my paper was to challenge the position that an operation should always be done, and it seems that Dr. O'Connor agrees with me, for he says "Few of us operate until we have eliminated the cases that are cured by glasses and visual training." I therefore have no quarrel with Dr. O'Connor, but with those "few."

Dr. O'Connor states that my cosmetic results were not very good, only 11 out of 27 cases being "straight," or about 40 per cent. There were, however, 6 other cases that were almost straight, so nearly so that only a careful examination showed any convergence. I may say that the patients and parents were quite satisfied with the results. If I seem to lay stress on the "cosmetic" results, it is because *that* is what the patient goes to the physician to have corrected. He is not interested in binocular vision and stereoscopic vision, for not having had them he does not miss them. If we attempt to give them these also, we may get "in many cases binocular vision of the second degree, and *occasionally* even stereoscopic vision." I submit that these terms are hardly statistical enough for argument, in fact I would ask the doctor to quote statistics giving in the exact terms, which he deprecates my not having used, the results of operative treatment in regard to the exact position of the eyes as well as the results so far as binocular vision and stereoscopic are concerned. I note that he does not claim that these latter are the result of the *operation*, but of the subsequent treatment. May I ask (Wilson), why that can not be carried out as well after correction with glasses as after correction with operation?

To again quote from Dr. Valk, "Finally I would like to ask the question, even though we are urged not to operate until all other methods fail, when should we operate on these cases? Or, to put the question in another way, should we not operate on all cases of squint?" That seems to me to be plain English, and does indicate that Dr. Valk considers, if he does not actually advocate, the possibility of dispensing with the usual nonoperative treatment.

To quote from De Schweinitz, Diseases of the Eye, 1916, p. 547—"if they (lenses) are worn early enough, and in addition fusion training is carried on, the strabismus will be cured in 30 to 70 per cent of cases;" page 551, "if possible operation should not be undertaken until the fusion faculty has been developed by the exercises already described, and in no circumstances until the refractive error has been fully corrected and glasses worn for at least six months. If the exercises have failed to develop the power of binocular fusion * * * * * * it would seem wise to wait * * * * * until after the period of rapid growth and development." As I understand this, it would mean until after the age of puberty at least.

Additional quotations would make this too long. In conclusion, I would like to sum up my paper in the following words, to which position I still adhere,—in view of the fact that many patients, or their parents, refuse operation but agree to the wearing of glasses, and in view of the fact that glasses will in a large number of cases (40 per cent of mine) correct the position of the eyes, and in view of the fact that by no means all operations are successful, some even resulting in strabismus of the opposite character, while the necessity for the wearing of glasses still remains, the position, whether stated outright or merely implied, that all cases of convergent strabismus should be operated is not a tenable one. Any other conclusions ascribed to me will be found unjustified on a careful reading of my paper.

Very truly yours,

CLARENCE LOEB.

BIOGRAPHIC SKETCHES.

LORENZO BURROWS, JR., Major M. R. C.—The many friends of Lorenzo Burrows, Jr., M. D., of Buffalo, N. Y., will

learn with sincere sorrow of his death, which occurred with the Army in France on September seventeenth.

Dr. Burrows was among the first to enlist when the United States declared war and was commissioned as Captain in Hospital Unit No. 23. He was actively engaged at the front when he was stricken with pneumonia from which he died.

Dr. Burrows was born in 1867 in Albion, N. Y., and graduated from the College of Physicians and Surgeons in New York in 1889. He served as an assistant to Dr. Fleming Carrow of Detroit in the University of Michigan, moving to Buffalo in 1890, where he practised ophthalmology with distinction until he entered the service in 1918. He was one of the ophthalmic surgeons of the Buffalo General Hospital and later on the staff of the Erie County Hospital and the Erie County, Eye, Ear, Nose and Throat Hospital. As an ophthalmic surgeon, Dr. Burrows was exceedingly skillful. He was a careful diagnostician.

His was an unusually frank and lovable disposition. He leaves a widow and five children, four members of his immediate family being also in service in France.

Lorenzo Burrows, Jr. Major, M. R. C. 1867-1918

He will be held in affectionate remembrance by his colleagues and by a wide circle of devoted friends. A recent number of the Army and Navy Journal mentions his promotion from the rank of captain to that of major in the United States Army.

F. Park Lewis.

LUTHER HALSEY GULICK, educator, author and specialist in physical training, died at South Casco, Me., August 13, 1918. He was born at Honolulu, H. I., December 4, 1865, and was brother of Frances Gulick Jewett and Sidney Lewis Gulick, both well known authors. He is of special interest to ophthalmologists because of his book, "Medical Inspection in Schools," which was first published in 1907.

T. H. S.

NEIL JAMIESON HEPBURN.—A well known ophthalmologist and otolaryngologist of New York City. He was born in the Orkney Islands, Scotland, October 8, 1846, son of David Guthrie and Janet Shearer Hepburn. His medical degree was received at the College of Physicians and Surgeons in the city of New York in 1868. He was ophthalmologist to the Manhattan Eye, Ear, and Throat Hospital for many years, and, at the time of his death, consulting surgeon to both this institution and the Paterson, N. J., Eye and Ear Infirmary. He was a member of the American Ophthalmological and Otological Societies, and a Fellow of the American College of Surgeons.

All who knew Dr. Hepburn speak highly of him. At school he was a bright, quick scholar, always passing his mates. Because of his extreme youth alone, he had to wait a year to enter the Free Academy (now City College) and yet another for his diploma from the College of Physicians and Surgeons. He was a man of impressive appearance, six feet tall, wiry, blond, wearing as a rule a mustache, and walking with a quiet and stately air. He was on the Sanitary Commission during the Civil War, and a captain of the Old Guard of New York in his later days. A member of the Dutch Reformed Church, he believed in the Bible from cover to cover. He married, May 5, 1869, Lucinda Pettit. He died at his home in New York City, May 28, 1918. T. H. S.

SAMUEL COBB NORRIS, Captain, M. R. C., U. S. Army, of Anderson, Ind., died at his home, August 4, of peritonitis, the result of some affection of the liver. He had practiced as ophthalmologist and otolaryngologist at Anderson for eighteen years. Dr. Norris was born at Cincinnati in 1870, received the medical degree at the Miami Medical College, Cincinnati, in 1894, and later, the bachelor of arts at Cincinnati University. He was for many years associate professor of Hygiene and Sanitary Science in Indiana University, Bloomington and Indianapolis, for the last nine years of his life city chemist at Anderson, and for a very long time editor of the Central State Medical Magazine.

Dr. Norris is survived by his widow and two children, as well as by several other relatives. The remains were interred at Spring Grove Cemetery, Cincinnati, with military honors.

T. H. S.

NEWS ITEMS

Personals and items of interest should be sent to Dr. Melville Black, 424 Metropolitan Building, Denver, Colorado. As these columns go to press on the 30th of the month contributors should send in their items by the 25th. The following gentlemen have consented to supply the News Item Editor with the news from their respective sections: Dr. Edmond E. Blaauw, Buffalo; Dr. V. A. Chapman, Milwaukee; Dr. Robert Fagin, Memphis; Dr. M. Feingold, New Orleans; Dr. Wm. F. Hardy, St. Louis; Dr. Geo. F. Keiper, LaFayette, Indiana; Dr. Geo. H. Kress, Los Angeles; Dr. W. H. Lowell, Boston; Dr. Pacheco Luna, Gautemala City, Central America; Dr. Wm. R. Murray, Minneapolis; Dr. G. Oram Ring, Philadelphia; Dr. Chas. P. Small, Chicago. It is desirable that this staff shall be enlarged until every city of importance in the United States shall be covered, as well as all foreign countries. Volunteers are therefore needed and it is hoped that they will respond promptly to this call.

DEATHS.

Dr. Horace R. Burns died from pneumonia following influenza October 18 at his home in Denver, Colo.

Capt. Lorenzo Burrows, M.R.C., Buffalo, New York. Aged fifty-one. Died in France, September 17th, from pneumonia.

Dr. Paul Guilford, of Chicago, died October 20th, from pneumonia following influenza.

Dr. Charles Devereux Marshall, of London,

died of cholera at Bombay, September 14, while on active service, aged 50 years.

Dr. J. M. Ray, died October 11th, in Louisville, Kentucky.

PERSONALS.

Dr. P. N. K. Schwenk, Ophthalmic Surgeon to Wills Hospital, Philadelphia, has been critically ill with pneumonia.

Dr. Edwin B. Miller, 2028 Chestnut Street, Philadelphia, has been appointed Assistant Surgeon to Dr. J. Milton Griscom, Wills Hospital.

Dr. George C. Yeager has been appointed Clinical Assistant on the Clinic of Dr. J. Milton Griscom, Wills Hospital, Philadelphia.

Col. Geo. E. de Schweinitz, of Philadelphia, delivered one of the patriotic addresses at the Bellevue Stratford Hotel in connection with the meeting of the Pennsylvania State Society held in Philadelphia on September twenty-fourth.

Dr. Ernest B. Mongel, of Philadelphia, has been appointed assistant surgeon, Dr. S. W. Newmayer and Dr. Jno. J. Wiley, clinical assistants to the out patient department of the Episcopal Hospital in the service of Dr. G. Oram Ring.

Doctor Samuel D. Risley, of Philadelphia, who has returned from a summer sojourn at Bear Lake, Luzerne County, Pennsylvania, gave a most scholarly presentment of "Uveal Disease and Its Sequellae" before the Eye, Ear, Nose and Throat section of the Medical Society of Pennsylvania at its annual meeting in Philadelphia, September twenty-fourth.

Dr. L. Webster Fox, of Philadelphia, returned recently from a vacation trip to the Pacific Coast, during which he visited his son, L. Webster Fox, Jr., who is First Lieutenant in the heavy Artillery and is located at Fort MacArthur, San Pedro, California. Dr. Fox had the rare pleasure of motoring from San Diego to Vancouver over the famous El Camino Road.

Dr. Wm. M. Sweet, of Philadelphia, who has served the American Ophthalmological Society for the past ten years as its secretary, has felt compelled to retire from that position because of pressure of other duties. An appropriate expression of the Society's profound appreciation of his services was unanimously voiced in an appropriate resolution. Dr. Sweet has been succeeded by Dr. Thos. B. Holloway, of Philadelphia.

Lieutenant Alexander Duane, of New York, visited the Opthalmic Section of the College of Physicians of Philadelphia on Thursday evening, October eighteenth, and read a most scholarly paper upon "The Basic Principles of Diagnosis in Motor Anomalies of the Eye."

Previous to the meeting, Lieutenant Duane was entertained at dinner by Dr. S. Lewis Ziegler, Acting President of the Section, at his country home at Haverford.

MILITARY NOTES.

Captain Harry Vanderbilt Würdemann. M. R. C., has been ordered to Camp Lewis.

Dr. E. S. Keitz, of New Orleans, has received a Lieutenant's commission in the Medical Corps and is stationed at Camp Beauregard, Louisiana.

Dr. L. M. Gurley, of Johnstown, Pennsylvania, has accepted a commission as Captain in the Medical Corps and has been assigned to Camp Sheridan, Alabama.

Dr. Samuel M. D. Marshall of Milford, Del., has been commissioned Captain in the Ophthalmic Department of the United States Army, and assigned to Camp Dix.

Lieutenants Shea and Stanford, of Memphis, with Base Hospital No. 57, have safely arrived overseas and are on active service with this Hospital Unit.

Dr. W. Likely Simpson, of Memphis, recently received a commission as Captain and has reported to Camp Greenleaf, Fort Oglethorpe, Georgia, for Military training.

Dr. L. Waller Deichler, Chief of the Eye Clinic at the Presbyterian Hospital, Philadelphia, has been appointed Ophthalmologist to Local Draft Board, No. 20.

Lieutenant-Colonel E. C. Ellett of Memphis, who recently sailed in command of a Head Unit of twenty-six surgeons has safely arrived overseas, and is on active duty.

Dr. Frank Barber, of Rochester, New York, has been commissioned First Lieutenant in the Medical Corps and is ordered to report at Camp Holabird, Baltimore, October twentieth.

Captain Chas. D. Blassingame, of Memphis, is now Ophthalmologist to Evacuation Hospital No. 49, and has recently left Camp Greenleaf with this Unit for overseas duty.

Lieutenant George L. Stephan, of Philadelphia, has been commissioned Captain in Field Hospital Company 110, 103rd Sanitary Train, American Expeditionary Forces, "Somewhere in France."

Dr. J. L. Blue, of Memphis, who has recently received a Lieutenant's commission, has reported to Camp Taylor, Louisville, Kentucky, and is very much pleased with his training there.

Dr. N. M. McFarland, of Memphis, has just completed the interneship at Brooklyn Eye and Ear Infirmary and has reported to Camp Greenleaf for military training. Dr. McFarland has received a commission as First Lieutenant.

Dr. Vard H. Hulen, of San Francisco, has been stationed at Base Hospital, Camp Dodge, Iowa, in the Department of Ophthalmology, since June twenty-sixth. He has recently been ordered to overseas service with the rank of Major.

At the request of the Federal Reserve Bank of Chicago, Government Bond Department, the following notice is published: "All United States Treasury Certificates of Indebtedness of Series IV. D., dated August 6, 1918, and maturing December 5, 1918, are hereby called for redemption on November 21, 1918, at par and accrued interest pursuant to the provision for such redemption contained in the certificates. On November 21, 1918, interest on all Certificates of said series will cease to accrue."

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(*For explanation see p. 747*)

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